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BOMBAY NATURAL HISTORY SOCIETY

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Rev. Fr. J. F. CAIUS, S.J., F.L.S., H. M. MCGUSTY,
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ERRATA

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Contents of Volume: The sub-title (Commentary by Whistler) has been misplaced and should appear as a sub-title to the Notes on the Birds of the Londa neighbourhood, printed immediately above.

Page 106, Misc. Note XI. The date at the end of the note should *read* 'November 30, 1941' *instead of* 'November 30, 1942'.

Misc. Note XIV, page 107. The date at the end of the note should *read* 'September 10, 1941' *instead of* 'September 10, 1942'.

VOL. XLIII, No. 2.

Page 242, line 2 (Obituary Note). The date of His Highness's birth should *read* '1866' *instead of* '1886'.

Page 254—plate opposite. In the description of Fig. 2 facing page 254, *for* 'genito-anal region' *read* 'terminal scale'. The references to this figure in the text should likewise be revised.

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The Golden Cestrum.
CESTRUM AURANTIACUM Lindl.
(nat. size).

NOTICE TO MEMBERS

The Committee of the Society has been compelled by war conditions to introduce a rigid economy in the Society's expenditure, and this has implied, among other things, a reduction in the size of the Journal.

It is sincerely hoped that members will understand the reasons which compelled the Society to adopt this course, and will continue to give the Society their co-operation and support in these critical times.

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VOL. XLIII.

No. 1.

SOME BEAUTIFUL INDIAN CLIMBERS AND SHRUBS.

BY

N. L. BOR, M.A., D.SC., F.L.S., I.F.S.,

Forest Botanist

AND

M. B. RAIZADA, M.SC.,

Assistant Forest Botanist,

Forest Research Institute, Dehra Dun.

PART X.

(Continued from Vol. xlii, No. 4 (1941), p. 703).

(With 1 coloured and 8 black and white plates and 5 text-figures).

Solanaceae.

THE DEADLY NIGHTSHADE FAMILY.

Solanaceae is derived from *Solanum*, a name used by Pliny to designate the well-known Bitter-sweet (*Solanum dulcamara* Linn.) a poisonous plant found in waste places in Europe.

The *Solanaceae* comprise herbs, erect or climbing shrubs, or even small trees. The leaves are usually alternate, entire, or lobed or cleft in various ways, exstipulate. The inflorescence is either lateral or terminal and the flowers are cymose or paniced or even solitary, regular, pentamerous or tetramerous. The corolla is gamopetalous, short and rotate or long and infundibuliform, rarely campanulate, more or less deeply lobed, sometimes entire; lobes 4-5-10. Stamens 4-5, inserted on the corolla tube; the filaments are very short and the anthers are either attached by the base or by the dorsal surface. Dehiscence is by pores or longitudinal slits. The ovary is in most cases 2-locular, rarely with 3-4-5 compartments; ovules many, on prominent peltate placentas; style linear; stigma capitate or shortly lobed. Fruit a berry or capsule, many-seeded. Seeds compressed, discoid or kidney-shaped.

The family contains many plants cultivated for food e.g., potato, tomato, Cape gooseberry, capsicum and tree tomato. The tobacco plant, *Nicotiana Tabacum* Linn., is widely cultivated in this country. The family also contains many well-known ornamental plants among which are *Browallia*, *Petunia*, *Solanum*, *Brunfelsia*, *Datura*, *Cestrum*, *Schizanthus* and *Salpiglossis*.

Apart from the value of the family to horticulturists, many species found wild in nature are prized as drug plants. The Deadly Nightshade, *Atropa Belladonna* Linn., derives its specific name from the fact that in bygone days ladies in Italy used the leaves to impart lustre to their eyes and so enhance their beauty. The plant actually contains a drug (atropine) which is used for ophthalmic complaints, for neuralgia and as a valuable antidote in opium poisoning. One of its effects is to enlarge the pupil of the eye. The berries are sweet and poisonous and are often eaten by children with fatal results. The name *Atropa* is from the Greek, *Atropos*, one of the Fates who cut the thread of life, and has reference to its deadly poisonous nature. *Belladonna* is found wild in India on the Himalayan ranges of the Punjab, Kashmir and Lahoul.

The Henbane (*Hyoscyamus niger*, Linn.) is a common plant of rather high altitudes in the western Himalayas. It is supposed to be fatal to fowls hence the trivial name. In the middle ages in Britain it was used for toothache. The alkaloids it contains are narcotic and antispasmodic.

Two species of *Withania* Pauq., *W. coagulans* Dunal and *W. somnifera* Dunal, are found in India. The former is found in the Punjab, Sind and Baluchistan. The seeds have the interesting property of being able to coagulate milk, and hence can be used as a substitute for animal rennet. The fresh fruit can be used as an emetic. *W. somnifera* Dunal, found in Bombay, possesses an alkaloid which is used in rheumatism, as an aphrodisiac and as a cure for scorpion sting.

Datura is another genus with poisonous properties. An account of these properties will be found under the genus.

No account of the *Solanaceae* would be complete without some mention of the Mandrake, a plant famous in legend and history. This genus of plants, *Mandragora*, has been for many centuries, and is even today, regarded with superstitious awe. All this superstition has arisen because the thick fleshy root bears a remote resemblance to a human figure. To that resemblance can be directly traced the belief that the plant shrieks when pulled from the earth.

Apart from this, however, it was known in ancient times as an aphrodisiac and also as an anaesthetic. According to F. W. Jones¹, 1935, it is a well-attested fact that Hua T'o, the great Chinese surgeon, who was born in the first century after Christ, performed major operations (such as the removal of the spleen) upon patients to whom he had administered a drug that produced insensibility. Part of the fame of that fabled plant, the mandrake, rests upon the fact that it was the first anaesthetic discovered by man. Its properties have been known for over three thousand years, but only

¹ Jones, F. W., Syme Oration, 'The Master Surgeon,' 1935.

comparatively recently has it been shown that it contains hyoscyne, hyoscyamine and scopolamine as well as other soporific alkaloids. In ancient medicine this plant was used to produce deep sleep and complete insensibility.

The roots of this plant, and the tuberous roots of certain other plants, are even at the present day, carved to resemble more nearly a human figure, and are hoarded by the superstitious as powerful magical charms.

As can be expected, a plant which had these valuable medical properties and which also possessed certain human characteristics, acquired in olden times the most extravagant reputation for magical powers. Theophrastus, for instance, in his history of plants, says that it is dangerous to gather it unless a sword is swung in a circle three times, and the face turned towards the west before the plant is lifted from the ground.



Fig. 1.—Harvesting the Mandrake.
(From a drawing in the Nürnberg Museum).

But listen to what Josephus wrote in the first century after Christ in his history of the Jewish war: 'In the valley in which the town of Macharus is situated, is found a wonderful root called Baara. In colour it is a fiery-red and in the evening it emits rays of light. It is difficult to pluck it because it avoids the hand of anyone who goes near, and in any case to touch it means certain death. There is a way, however, in which it can be collected quite harmlessly. You must dig away the soil from around the plant so that it is only attached to the earth by a single rootlet. A dog is taken and tied to the root. Its owner then calls it and it will run to him at the same time severing the rootlet. It immediately falls dead and then the plant can be handled without danger. Men take such great trouble because of its wonderful properties. It can even drive out evil spirits if it is brought near a sick person.' Baara was an early name of the mandrake. The accompanying sketch shows the conception of an artist of the Middle Ages of the way in

which the plant should be collected. It follows very closely the procedure recommended by Josephus.

KEY TO THE GENERA.

Flower trumpet-shaped or if salver-shaped with a short tube.

Fruit a drupe.

Corolla tube longer than the lobes. ... 1. *Cestrum*.

Corolla tube shorter than the lobes. ... 2. *Solanum*.

Fruit a capsule ... 3. *Datura*.

Flower salver-shaped with a long tube. ... 4. *Brunfelsia*.

PART I.

1. *Cestrum* Linn.

The name *Cestrum* is derived from the Greek word *kestron*, which was used by Dioscorides in his manual on medicinal plants to designate a Labiate, *Stachys officinalis* or *S. alopecuroides*. The word itself means pointed iron, or the style of the ovary, and may refer to the pointed anthers of these plants. Why Linnaeus applied the name *Cestrum* to this genus is not known.

This genus comprises shrubs or small trees. Leaves alternate, entire, petioled or subsessile, exstipulate, often with an unpleasant odour when bruised. Inflorescence in axillary or terminal cymes or panicles. The calyx is usually short, campanulate or cylindric, 5-lobed or 5-partite. Corolla usually fragrant, green, white, yellow, orange or even reddish; tube elongate, cylindrical or narrowly infundibuliform, sometimes bell-shaped at the mouth and then contracted, 5- or more-lobed or 5-partite; lobes spreading, much shorter than the tube, with the margins often incurved, glabrous or hairy. Stamens 5, included. Filaments adnate to the corolla for a large portion of their length, often dilated or hairy at the point of insertion and provided with an appendage of variable shape; anthers globular, deshiscing longitudinally. Ovary 2-celled; ovules few; style filiform, more or less glandular at the summit; stigma capitate. Fruit an oblong or ovoid berry, black, purple or rarely white.

The *Cestrum*s are natives of South and Central America, but are now cultivated in the open in many parts of the warmer regions of the world or under glass in temperate latitudes.

When flowering the flowers are usually to be found pendulous, a position which ensures that the pollen is not wetted and rendered ineffective by rain.

Owing to the fact that the flowers of *Cestrum* are fragrant, it is to be inferred that this is a device to secure cross fertilisation. In the case of some species the flowers are only fragrant at night which leads one to believe that the unconscious agent of cross-pollination is a night-flying insect.

If cross-fertilisation is not accomplished the flowers still possess a mechanism which ensures self-pollination. When the stigma has been fertilised the style decays. On the other hand when the anther cells have opened the corolla becomes detached from the receptacle. Should the style have decayed as a result of fertilisation the corolla can drop off. If, however, the style is still intact

the corolla is prevented from dropping off by the appendages at the base of the filaments. These appendages vary in shape but are often tongue-like processes which curve inwards round the style. The corolla on becoming detached is prevented from dropping off immediately by the tips of the appendage becoming locked under the capitate stigma. There is, therefore, every likelihood of self-fertilisation taking place even though cross-fertilisation has not been accomplished through the agency of insects.

KEY TO THE SPECIES.

Flowers reddish.	...	...	...	...	<i>C. elegans.</i>
Flowers white, green or varying shades of yellow.					
Lobes of corolla blunt, becoming distinctly reflexed.					
Corolla orange-yellow.	...	...	...	...	<i>C. aurantiacum.</i>
Corolla white.	...	...	...	...	<i>C. diurnum.</i>
Lobes acute, erect or spreading.					
Leaves oblong-ovate, shortly acuminate, not foetid when bruised.	...	...	...	...	<i>C. nocturnum.</i>
Leaves lanceolate, very long tapering, very foetid when bruised.	...	...	...	...	<i>C. Parqui.</i>

***Cestrum elegans* Schlecht.**

Description.—A large shrub with pendulous, leafy branches; branches cylindrical, covered with a soft velvety pubescence. Leaves



Fig. 2.—*Cestrum elegans* Schl. $\times 3/4$.

alternate, exstipulate, shortly petioled, lanceolate or oblong-lanceolate in shape, quite entire, tapering to a point, 3-4 in. long, up to 1 in. wide, covered on both surfaces with short, crisped hairs, particularly so on the nerves beneath, deep green in colour, membranous in texture, rounded, acute or obscurely cordate at the base; petiole .1 in. long, pubescent.

Inflorescence in axillary or terminal dense, pendulous, thyrsoid, compound racemes. Individual flowers subtended by hairy bracteoles, sessile or subsessile. Calyx .2 in. long, top-shaped, green, hairy, 5-lobed; lobes broadly triangular-ovate, acuminate, erect. Corolla purplish-red, tubular, gradually inflated then contracted below the mouth, glabrous, .75 in. long. Lobes 5 or more, triangular, acute, very shortly ciliate on the margins, mouth and inner surface glabrous. Stamens as many as the corolla lobes and alternate with them; filaments inserted two-thirds the way down the tube, filiform; anthers included, small, yellow. Ovary globose, shortly stipitate, seated in a disk, 2-celled, ovules few on the axile placentas; style slender; stigma capitate. Fruit a berry, .5-.75 in. in diameter, fleshy, deep red-purple in colour, 2-celled, many-seeded.

Flowers.—September-December.

Distribution.—Native of Mexico, largely grown in gardens in temperate countries.

Gardening.—A shrub eminently suitable for growing in hill stations. The red purple flowers which are borne in dense, terminal drooping cymes are produced almost continuously throughout the year and make this shrub a very attractive object. It prefers partial shade and rich well-drained soil and is propagated by cuttings.

***Cestrum aurantiacum* Lindl.**

(*aurantiacum* is a Latin word meaning orange-red, and refers to the colour of the flowers).

Description.—An erect or scrambling shrub, glabrous or young parts puberulous. Leaves alternate, stipulate, petioled, ovate-acute or ovate-acuminate in shape, membranous in texture, entire, glabrous, dark green in colour, somewhat undulate on the margins, 3-4 in. long, up to 2.5 in. broad; petiole .75 in. long.

Inflorescence axillary or terminal in pedunculate, racemose or paniced clusters; peduncles often pubescent. Lower flowers pedicelled, the upper sessile or subsessile, bracteolate; bracteoles leaf-like, narrow, lanceolate, puberulous. Calyx gamosepalous, .25-.3 in. long, cylindrical-campanulate, 5-ribbed, each rib continued above into a linear awl-like lobe. Corolla tube constricted at the base, obconical in shape, orange-red in colour, .9 in. long, .3 in. wide at the top, ribbed; ribs double the number of the lobes. Lobes ovate-obtuse, completely reflexed at full anthesis, 5-7 in number. Stamens corresponding in number to the lobes and alternate with them; filaments inserted in the tube, adnate to the lower half of the tube, free in the upper half, included, appendaged; appendage bracket-like, glandular. Ovary seated on an obscure fleshy disk; style slender; stigma capitate.

Flowers.—October-December. Does not fruit in this country.

Distribution.—Native of Guatemala, now commonly cultivated in the warmer and temperate regions of the whole world.

Gardening.—A pretty bushy shrub with scentless orange flowers borne in panicles. It will grow up to 10 ft. or so and can withstand considerable moisture. Six weeks after flowering the plant should be well cut back in order to obtain a shapely bush and induce profuse



Photo by

M. N. Bakshi

The Golden Cestrum.

Cestrum aurantiacum Lindl.

Botanic Garden, Forest Research Institute, Dehra Dun.





photo by

M. N. Bakshi

The Day Jasmine.
Cestrum diurnum Linn.
New Forest, Dehra Dun.



Photo by

The Day Jasmine.
Cestrum diurnum Linn.
New Forest, Dehra Dun.

M. N. Bhatia

flowering. It prefers rich soil and is propagated by cuttings. This plant forms a very pretty green-house shrub and as its flowers do not drop off easily it has become a great favourite in all European gardens.

***Cestrum diurnum* Linn.**

THE DAY JASMINE.

Description.—An erect shrub with numerous leafy branches. Branches green (fawn in age) with well-marked, white lenticels; young parts covered with a very sparse glandular scurf. Leaves



Fig. 3.—*Cestrum diurnum* Linn. $\times 1/1$.

alternate, exstipulate, petiolate, dark green above, pale below, glabrous, entire, obtuse at the apex, obtusely wedge-shaped below, ovate-lanceolate in shape, up to 5 in. long by 1.5 in. wide; petioles up to .5 in. long.

Inflorescence a long axillary peduncle bearing short clusters of white sweet-smelling flowers, each cluster supported by a leaf-like bract. Individual flowers sessile, with or without bracteoles, calyx gamosepalous, about .15 in. long, somewhat puberulent, obtusely 5-ribbed, 5-lobed; lobes obtuse, ciliate. Corolla tube narrowly infundibuliform, white, sweet-scented, about .5 in. long, 5-lobed; lobes very obtuse, completely recurved when the flower is

fully open. Stamens oblong, 5 in number, alternate with the corolla lobes, brown in colour, included; filaments adnate to the tube, free for a very short distance. Ovary seated on a nectary-secreting disk; style filiform, glabrous; stigmas truncate-capitate. Berry nearly globular, black.

Flowers.—Rainy season. Fruits cold season.

Distribution.—Native of the West Indies, widely cultivated in gardens throughout the country.

Gardening.—A quick-growing evergreen shrub with dark green foliage and white flowers that are very sweet scented during the day. It is well suited for screens and borders. Easily propagated by seed which it produces abundantly. It is advisable to prune it after flowering so as to prevent it from becoming ragged.

***Cestrum nocturnum* Linn.**

Lady of the Night. Night Jessamine. Rat-ki-rani (Hind.). (The specific name refers to the fact that this plant opens its flowers at night).



Fig. 4.—*Cestrum nocturnum* L. $\times 3/4$.

Description.—A glabrous shrub reaching a height of 9 ft. Branches slender, smooth, often yellowish with numerous lenticels. Leaves alternate, exstipulate, ovate-oblong, acute at the apex, cuneiform or rounded at the base, membranous in texture, entire, glabrous, up to 4 in. long by 1.5 in. wide; petioles up to .5 in. long.

Inflorescence in many-flowered, pedunculate, axillary or terminal panicles, exceeding by much the length of the leaves; common peduncles up to 1 in. long, erect or spreading. Individual flowers supported by a lanceolate bract, pedicelled or subsessile. Calyx campanulate, sparsely glandular, .15 in. long, glabrous, with 5 small triangular teeth, which are acute, scarious and short ciliate at the tips. Corolla greenish, sweet-smelling at night, tube cylindrical or narrowly infundibuliform, about .75 in. long, .1 in. broad at the top; lobes 5, ovate-acute, margins incurved; stamens 5, alternate with the lobes of the corolla; filament adnate to the corolla tube for a quarter of its length from the top,



Photo by

M. N. Bakshi

Lady of the Night.
Cestrum nocturnum Linn.
New Forest, Dehra Dun.



Photo by

Lady of the Night,
Cestrum nocturnum Linn.
New Forest, Dehra Dun.

M. N. Baks



Photo by

Willow-leaved Jasmine
Cestrum Parqui L'Heritier.
New Forest, Dehra Dun.

M. N. Bakshi



Photo by

Willow-leaved Jasmine
Cestrum Parqui L'Heritier.
New Forest, Dehra Dun.

M. N. Bakshi

provided at the junction with a linear-acute appendage. Ovary globular, seated on a fleshy disk which probably secretes nectar; style filiform, glabrous; stigma capitate, above the stamens. Fruit a blue or blackish berry, ovoid in shape, about .16 in. long. Seeds numerous, compressed.

Flowers.—Practically throughout the year, but most profusely during the rains. Fruit cold season.

Distribution.—Indigenous to the West Indies. Largely cultivated throughout the plains of this country.

Gardening.—A hardy sub-scandent, quick-growing shrub about 10 ft. high. The small, greenish and rather inconspicuous flowers, which are produced in great profusion open at night, and are strongly sweet-scented. It is a great favourite with Indians and is extensively cultivated in their gardens. This shrub is well adapted for tall borders and screens and can easily be trained on a trellis. It is hardy and drought resistant. Very easily propagated by cuttings.

Cestrum Parqui L'Héritier

WILLOW-LEAVED JASMINE.

(*Parqui* is the Chilean name of this plant and was once proposed as the generic name).



Fig. 5.—*Cestrum Parqui* L'Hérit. $\times 1/2$.

Description.—A shrub reaching 4-5 ft. in height. Branches cylindrical, glabrous, greenish, covered with small greenish-white lenticels. Leaves petioled, alternate, exstipulate, lanceolate, long tapering at the apex, up to 6 in. long; .5-.75 in. wide, very foetid when bruised, entire, glabrous, margins undulate; petioles short, scarcely .1 in. long.

Inflorescence in pedunculate unbelliform cymes or panicles, many-flowered, not exceeding the leaves in length. Individual flowers sessile, supported by a linear bract. Calyx gamosepalous, cylindrical, sparsely glandular without, about .1 in. long, with 5 acute, triangular, ciliate teeth. Corolla gamopetalous, fragrant at night, glabrous, pale yellow in colour, about .75 in. long, narrowly infundibuliform in shape, .15 in. wide at the top. Lobes ovate-acute, ciliate on the margins which become revolute in age, slightly tinged with purple on the outside. Stamens 5; alternate with the lobes of the corolla; filaments inserted on the corolla about $\frac{1}{3}$ its length from the top; stamens globose; appendage absent. Ovary globose, seated on an inconspicuous disk; style elongate, glabrous; stigmas truncate-capitate.

Flowers.—More or less throughout the year. Fruits cold season.

Distribution.—Native in the mountains of Chile, South America, now largely cultivated in the tropical and sub-tropical parts of the globe.

Gardening.—A shrub about 4-5 ft. high, with leaves that have a foetid smell when bruised. The greenish-yellow flowers are very fragrant at night. It was introduced into England in the year 1787. Easily propagated by seed.

(To be continued.)

NOTES ON THE BIRDS OF THE LONDA NEIGHBOURHOOD, BOMBAY PRESIDENCY.

BY

WALTER KOELZ.

In 1938 I spent from January 7 to March 13 in the vicinity of Londa, North Kanara, Bombay Presidency, and among other things, collected birds. The region covered during the course of this collecting was roughly the triangle, about 15 miles on a side, formed by a line joining Londa, Supa and Castle Rock. The area is in the peneplain of the Western Ghats with an average elevation of about 2,000 feet. The terrain consists of worn-down knobs and low hills with well-formed and numerous drainage channels. In general, the mountain-core is covered with earth, with outcroppings only on certain shoulders, and most of the region is forested. The soil on the elevations is generally thin and there the forest growth is scrubby and the species are mainly deciduous. Where the soil is deeper the growths become denser and evergreens become increasingly important. Scattered through most of the area there are small clearings, given over to rice growing, with somewhere at the side, the clustered huts of the cultivators. For the most part, the fields were fallow in winter, for want of water to irrigate them, but in favoured places at the lower levels the rice was being transplanted in February. The largest of these small settlements are Castle Rock and Londa, each with a railroad station, Supa and Jagalbed, all of them with a post office. The only extensive strip of unbroken forest in the delimited area is that between Jagalbed and Supa, and in it there are patches of well-grown trees. One also sees groves of such even among the clearings. There is abundant water in the streams, even in winter, so that crocodiles lived within a stone's throw of the railway station at Londa, and the large river at Supa was far too deep to wade. Ponds were small and rare. Water birds were limited in numbers and of few species, and some widely-distributed species, like ducks, were totally absent. Land birds were plentiful and many of the species were generally distributed and of common occurrence. Only a few were rare. There were few suitable habitats for species like *Saxicoloides fulicata*, *Monticola s. pandoo* and *Rhophodytes viridirostris*, and some like *Ceyx tridactylus*, *Halcyon pileata*, *Dinopium j. malabaricum*, *Arachnothera l. vantlynei*, *Alseonax m. muttui* seemed to prefer relatively restricted parts of major habitats. A few species like *Oreocincla d. neilgherriensis*, *Hippolais c. rama*, *Muscicapa p. albicilla*, *Lalage m. melaschista*, *Ploceus p. travancoreensis*, *Circus pygargus*, *Ducula b. cuprea*, reported from single specimens, may be strays in the region or seasonally absent. *Anthus r. godlewskii* was apparently a short-stay visitor.

Specimens collected are in my collection.

Corvus macrorhynchos culminatus Sykes. The Southern Jungle-Crow.

Occurred in some numbers around the villages.

Wing measurements 3 ♂ 289-304; 3 ♀ 278-301 mm.

Corvus splendens splendens Vieillot. The Common Indian House-Crow.

Occurred with the preceding.

Wing measurements 2 ♂ 267, 270; 3 ♀ 262-264 mm.

Dendrocitta vagabunda. The Indian Tree-Pie.

Common, in pairs in the open jungle. Londa birds are much larger and paler than the Malabar race *parvula* and are darker than *pallida* of the north.

Wing measurements 7 ♂ 143-150; 6 ♀ 140-150 mm.

Machlolophus xanthogenys xanthonotus Koelz¹.

Occurred everywhere except in the dense forest, usually in small flocks or in pairs most often in company with foraging flocks of other birds. These troupes usually contained: *Sitta f. simplex*, *Alcippe p. brucei*, *Ægithina t. humei*, *Iole icterica*, *Hemipus p. picatus*, *Tephrodornis g. sylvicola*, *Chaptalia a. malayensis*, *Pericrocotus flammeus*, *P. c. cinnamomeus*, *Phylloscopus o. occipitalis*, *P. n. nitidus*, with at least a half dozen of each species. Other species were often to be found also and it was always worthwhile to follow the army as it moved, not too leisurely, in a broad band through the forest. Several such troupes could be found in the course of a half-day's travel. In early morning the members were most conspicuous.

Sitta frontalis simplex Koelz¹.

The species was found frequently, single or in pairs, often in the wandering troupes.

Garrulax delesserti (Jerdon). The Wynaad Laughing-Thrush.

A flock of about a dozen was found in a dense thicket near Castle Rock on March 6 and 7 and three were collected. No others were seen.

Turdoides somervillei malabaricus (Jerdon). The Malabar Jungle Babbler.

This species was abundantly represented in flocks of about a dozen noisy members at the border of fields or throughout the scrub forest. They liked particularly the camps where the oxcart-drivers stopped to refresh themselves and their animals, and were there very tame. I always looked to see what the cause was when they made a special commotion, because elsewhere I have found the species helpful in locating small owls, but here I seldom found out a reason for their excitement and only a few times found a bird, always *Ketuṣa*.

Wing measurements 4 ♂ 101-106; 6 ♀ (93) 101-109 mm.

Argya subrufa (Jerdon). The Rufous Babbler.

Occurred in flocks of 6-8, most often at the edge of the forest. The birds were as a rule rather quiet and probably were often overlooked. A flock might be found everyday by looking in the right places.

Wing measurements 7 ♂ 90-93; 6 ♀ 88-92.5 mm.

Pomatorhinus horsfieldii travancorensis Harington. The Southern Indian Scimitar-Babbler.

Common in small flocks usually in the thickets but also often in the tree tops with the mixed troupes. They have a variety of notes and their

¹ Walter Koelz, 'New Birds from Asia, Chiefly from India', *Proc. Biol. Soc., Washington*, 52, June 5, 1939, pp. 61-82.

vocalization is one of the liveliest features of the jungle. Londa birds are similar to my series from the Palnis and Nilgiris.

Wing measurements 8 ♂ (94) 99-101.5; 7 ♀ 88-96 mm.

Dumetia hyperythra albogularis (Blyth). The White-throated Babbler.

Flocks of about 10 were found occasionally, most often in the thickets at the edge of fields or along water.

Wing measurements 8 ♂ (52) 55-57; 8 ♀ 52-55.5 mm.

Pellorneum ruficeps ruficeps Swainson. The Spotted Babbler.

An abundant species, occurring in pairs, always in the scrub forest. Collected specimens are much like a series from Mahendra Giri, Orissa with a tendency to be somewhat richer in color.

Wing measurements 10 ♂ (70) 73-76; ♀ 66-73 mm.

Alcippe poiocephala brucei Hume. The Bombay Quaker-Babbler.

One of the common species, found in flocks of 6-10 in deep woods or in open scrub, a common constituent of the mixed troupes. Specimens taken in early March were breeding. Collected specimens are like a series from Mahendra Giri, Orissa.

Wing measurements 4 ♂ 72-73.5; 9 ♀ 66.5-71 mm.

Rhopocichla atriceps atriceps (Jerdon). The Black-headed Babbler.

Like the preceding but not so commonly found in the travelling flocks and more often near the ground. March specimens were nesting.

Wing measurements 4 ♂ 58.5-61; 7 ♀ 56.5-58.5 mm.

Ægithina tiphia humei Stuart Baker. The Central Indian Iora.

One of the common elements of the troupes. Specimens taken prior to March show no black feathers on the body proper.

Wing measurements 8 ♂ 63-66; 6 ♀ 62-63.5 (65) mm.

Chloropsis aurlirons davidsoni Stuart Baker. The Malabar Chloropsis.

Usually occurred in pairs and were found feeding on the *Butea frondosa* blooms.

Wing measurements 10 ♂ (87.5) 91-97; 3 ♀ 86-88.5 mm.

Microscelis psaroides ganeesa (Sykes). The Southern Indian Black Bulbul.

I have usually found this and others of its races to occur in flocks, but at Londa I never saw more than pairs. They were not common but occurred throughout the region wherever there were trees.

Wing measurements 10 ♂ 112-120; 3 ♀ 107.5-111 mm.

Molpastes cafer cafer (Linnaeus). The Ceylon Red-vented Bulbul.

This was one of the commonest birds. Usually small flocks were seen, most often in the thickets around fields.

Wing measurements 4 ♂ 91.5-96; 11 ♀ 87.5-90 (92) mm.

Otocompsa jocosca fuscicaudata Gould. The Southern Red-whiskered Bulbul.

Like the preceding, but more numerous. One specimen taken January 26 has only one leg. The stump is completely healed. One ♀ has albino primaries on both wings. One other specimen has the entire plumage stained light brown.

Wing measurements 8 ♂ 84-87; 2 ♀ 80, 81 mm.

Iole icterica icterica (Strickland). The Yellow-browed Bulbul.

This was a common element in the troupes and occurred most often in flocks of 6-10.

Wing measurements 10 ♂ (90) 92-96; 4 ♀ 88.5-90.5 mm.

Pycnonotus gularis (Gould). The Ruby-throated Bulbul.

Only four specimens were taken, though others were seen. The species was rather rare and was seen only in the thickets on low ground along the rivers.

Wing measurements ♂ 76; 3 ♀ 70-72 mm.

Pycnonotus luteolus luteolus (Lesson). The White-browed Bulbul.

This species was not seen except at Londa where one or two were found on several occasions in a suitable patch of bushes on a dry slope. The birds stay hidden in the bushes and unless they sing or call they would be overlooked.

Wing measurements 2 ♂ 89, 90 mm.

Microtarsus poiocephalus (Jerdon). The Grey-headed Bulbul.

In the brushy country about Castle Rock the species was rather common. Usually several were found together. Though they stayed hidden in the thickets they were usually calling.

Wing measurements 8 ♂ 76-79.5; 3 ♀ 73-77 mm.

Saxicola caprata rupchandi Koelz¹.

Occurred in the fallow fields, in pairs. Common.

Saxicola torquata maura Pallas.

Found in the same situations as the last, but rather rare.

Wing measurements 3 ♂ 67-69.5; 2 ♀ 61.5, 66 mm.

Phenicurus ochruros rufiventris (Vieillot). The Eastern Indian Redstart.

Two females were taken and two others were seen.

Wing measurements 83 mm.

Luscinia suecica (Linnaeus).

A few individuals could always be found along the rivers where the beds were half dry and thin bushes and grass offered shelter. Around the fallow fields they also found a suitable habitat. For want of named material of the many Siberian races I am unable to assign a subspecific name to these birds.

Wing measurements 3 ♂ 68, 72, 75; 10 ♀ (67.5) 69-72 mm.

Luscinia pectoralis pectoralis (Gould).

Only a single specimen was observed, a female collected in an old rice field on February 15 (W 75 mm.).

Tarsiger brunnea brunnea (Hodgson). The Indian Blue Chat.

Found singly, usually in the undergrowth of heavy forests, or in heavy undergrowth on damp ground.

Wing measurements 7 ♂ 73.5-80; 4 ♀ 72-75.5 mm.

Saxicoloides fulicata ptymatura (Vieillot). The Indian Black-backed Robin.

Rare, probably because the dry open areas with low stunted bushes that the species likes are not developed in the Londa neighbourhood.

Wing measurements ♂ 76; 2 ♀ 68, 70 mm.

Whistler (*J.B.N.H.S.*, xxxviii, p. 286) has decided Vieillot's name may be used for the race of Southern India. My Londa birds differ from the Ceylonese *fulcata*, *intermedia* of northern Madras Presidency, and the brown-backed race of Northern India. I have seen no specimens from anywhere near Pondicherry, which has been designated as the type locality (l.c.) and it may be that Vieillot's name is not applicable to these specimens.

¹ Walter Koelz, 'New Birds from Asia, Chiefly from India', *Proc. Biol. Soc., Washington*, 52, June 5, 1939, pp. 61-82.

Copsychus saularis saularis (Linnaeus). The Indian Magpie.

Common in pairs, chiefly in the thickets around the edges of fields or along open streams. The specimens taken differ from Bengal birds in having a shorter wing and the females average somewhat darker. They differ more from the Ceylon race *ceylonensis*. Males of the later are possibly more purplish, and have a heavier bill and longer tail and females are darker.

Wing measurements 7 ♂ 95-100.5; 5 ♀ 91.5-94 (97) mm.

Kittacincla malabarica malabarica (Scopoli). The Shama.

Pairs were found not uncommonly, usually where there were bamboo clumps in shade. During the latter part of the collecting period, males were often singing.

Wing measurements 13 ♂ 93-99; 7 ♀ (84) 86.5-91 mm.

Turdus simillimus mahrattensis Kinnear and Whistler. The Black-capped Blackbird.

This species was common, mostly in rather dark and damp forest. Usually a small flock was seen.

Wing measurements 7 ♂ 126-133; 8 ♀ (118) 121-126 mm.

Geokichla citrina cyanotus (Jardine and Selby). The White-throated Ground-Thrush.

Scattered individuals were common in the forest, almost always near or on the ground.

Wing measurements 4 ♂ 107-112; 10 ♀ 105-109 mm.

Oreocincla dauma neilgherriensis Blyth. The Nilgiri Thrush.

A single specimen was taken in a dark ravine on January 13 and though I always kept on the look out, no more were seen.

Monticola cinclorhyncha (Vigors). The Blue-headed Rock-Thrush.

Scattered individuals were not uncommon in the dry scrub jungle, often with the travelling troupes.

Wing measurements 10 ♂ (97) 99-106; 11 ♀ 96-103 mm.

Monticola solitaria pandoo (Sykes). The Indian Blue Rock-Thrush.

Two males were collected, the only individuals of the species seen, on March 1 and 12. There are in the Londa neighbourhood low peaks with rock outcroppings, such as this species likes to frequent, but I did not visit them.

Wing measurements 114, 115.5 mm.

Myophonus cœruleus horsfieldii Vigors. The Malabar Whistling Thrush.

The species was found on wet ground in heavy forest only, where it was common. No birds were singing.

Wing measurements 8 ♂ (150) 153.5-158 (168); 9 ♀ 143-151 (155) mm.

Muscicapa parva parva Bechstein. The European Red-breasted Flycatcher.

Individuals were frequently found, usually in the thin brush fringes around the clearings. About half of collected specimens were in immature plumage.

Wing measurements 10 ♂ (65.5) 67-71.5; 7 ♀ 64-67 mm.

Muscicapa parva albicilla Pallas. The Eastern Red-breasted Flycatcher.

An adult male was taken on January 13; Wing 71 mm.

Muscicapula pallipes pallipes (Jerdon). The White-bellied Blue Flycatcher.

Individuals or pairs were commonly found in the low cover of dense shade.

Wing measurements 15 ♂ (73.5) 75-80; 16 ♀ 70.5-74 mm.

Muscicapula rubeculoides rubeculoides (Vigors). The Blue-throated Flycatcher.

The species was rare. It occurred in thickets, usually at the edge of heavy forest. Specimens collected appear indistinguishable from those of a series taken in Bhadwar, Kangra District, Punjab.

Wing measurements 5 ♂ 71.5-77.5; ♀ 68 mm.

Muscicapula tickelliae tickelliae (Blyth). Tickell's Blue Flycatcher.

A common species, usually in the scrub jungle, and elsewhere, mainly in bushes.

Wing measurements 9 ♂ (69) 71-74.5; 12 ♀ 68-72.5 mm.

Eumyias thalassina thalassina (Swainson). The Verditer Flycatcher.

Occasional specimens were found, usually in dense trees, like Mango, most often in clearings.

Wing measurements 5 ♂ 81.5-85 (88.5); 6 ♀ 78-81.5 mm.

Alseonax latirostris poonensis (Sykes). The Indian Brown Flycatcher.

The species was not common. Occasional specimens were found in such situations as *Eumyias* frequented. Collections of this species from various parts of India show curious variations in size and color and only when breeding material is available will it be possible to understand their meaning.

Wing measurements 6 ♂ 69-72; 2 ♀ 67, 69 mm. Breeding birds of Baijnath, Kangra Dt., Punjab: 5 ♂ 69-71.5; 2 ♀ 69, 70 mm.

Alseonax muttui muttui (Layard). Layard's Flycatcher.

Along open streams in thick forest these flycatchers were occasionally found.

Wing measurements 2 ♂ 72, 75; 2 ♀ 67.5, 71 mm.

Tchitrea paradisi paradisi (Linnaeus). The Indian Paradise Flycatcher.**Tchitrea paradisi leucogaster** (Swainson).

Paradise flycatchers were not uncommon and occurred generally, except in the deep forest. Only two specimens of the 10 in female plumage are of the typical race, and two of the 11 adult males. The rest are *leucogaster*.

Hypothymis azurea similis Koelz¹.

A common bird, usually found in thickets and scrub jungle in pairs. It was often associated with the travelling troupes.

Lanius schach erythronotus (Vigors). The Rufous-backed Shrike.

Shrikes were rather common, singly or in pairs, usually in the thickets about fields.

Wing measurements 9 ♂ (92.5) 94-98; 6 ♀ 92-95 mm., as compared with Kulu (virtually topotypical) 12 ♂ (86) 88-95; 2 ♀ 87-89 mm. Strangely, no specimens of *caniceps* were taken, though I have found that race in the Nilgiris and at Udaipur.

Lanius cristatus cristatus Linnaeus. The Brown Shrike.

Occasional specimens were found in all sorts of woody habitats, even in the undergrowth of the dense forest.

Wing measurements 7 ♂ 82-88; 9 ♂ 84.5-88 mm.

¹ Walter Koelz, 'New Birds from Asia, Chiefly from India', *Proc. Biol. Soc., Washington*, 52, June 5, 1939, pp. 61-82.

NOTES ON THE BIRDS OF THE LONDA NEIGHBOURHOOD 17

Hemipus picatus picatus (Sykes). The Black-backed Pied Shrike.

This was one of the common species of the hunting bands; some half dozen were usually found together.

Wing measurements 7 ♂ 60.5-66; 6 ♀ 61-63 mm.

Tephrodornis gularis sylvicola Jerdon. The Malabar Wood-Shrike.

This was one of the common elements of the hunting troupes; often a dozen or more were seen together. When called, they were tame and curious.

Wing measurements 7 ♂ 114.5-120; 9 ♀ 114-119.5 mm.

Tephrodornis pondicerianus warei Koelz¹.

Common in pairs or in small parties in the thin scrub jungle. Birds taken in early March were getting ready to breed.

Pericrocotus flammeus (Forster). The Orange Minivet.

A common element of the mixed assemblies, usually in small parties.

Wing measurements 12 adult ♂ 87.5-94; 7 ♀ 87-95.5 mm.

Pericrocotus cinnamomeus cinnamomeus (Linnaeus).

About as common as *Tephrodornis p. warei* and of about the same ecological preferences. Specimens taken are like those of Ceylon in color.

Wing measurements 7 ♂ 68.5-71; 5 ♀ 68-71.5 mm.

Lalage melaschista melaschista (Hodgson). The Dark Grey Cuckoo-Shrike.

I got a female on February 8, the only time the species was seen.

Lalage sykesi sykesi Strickland. The Black-headed Cuckoo-Shrike.

Usually found singly, and not uncommonly in the bamboo clumps in more open country.

Wing measurements 13 ♂ (98) 100-106; 8 ♀ 98-103 mm.

Graucalus javensis macei (Lesson). The Large Indian Cuckoo-Shrike.

Rather rare. Seen singly or in pairs in the heavy forest or in the larger trees of the open country.

Wing measurements 4 ♂ 157-161; 2 ♀ 160, 161.5 mm.

Artamus fuscus Vieillot. The Ashy Swallow-Shrike.

Occasional flocks, of up to 8 individuals, were seen in the clearings, where the birds perched on some high dead tree, and from thence hunted flying insects.

Wing measurements 7 ♂ 132-138; 5 ♀ 130-137 mm.

Dicrurus longicaudatus longicaudatus (Jerdon). The Indian Grey Drongo.

Common in small flocks in the scrub jungle. March birds are moulting.

Wing measurements 11 ♂ 128-138 (148); 4 ♀ 127.5-144 mm.

Dicrurus caerulescens caerulescens (Linnaeus). The White-bellied Drongo.

Found in such situations as frequented by the last, but singly or in pairs.

Wing measurements 5 ♂ 116-127; 7 ♀ 115-122.5 mm.

Chaptalia ænea malayensis A. Hay. The Southern Bronzed Drongo.

A common element of the hunting bands, in pairs or small flocks.

Wing measurements 6 ♂ 111.5-122.5; 5 ♀ 111-118 mm.

¹ Walter Koelz, 'New Birds from Asia, Chiefly from India', *Proc. Biol. Soc., Washington*, 52, June 5, 1939, pp. 61-82.

Chibia hottentotta londæ Koelz¹.

Not uncommon in the blooming *Bombax* trees.

Dissemurus paradiseus malabaricus (Latham). The Malabar Large Racket-tailed Drongo.

One of the common birds of the forest trees. They occurred in pairs, or sometimes there would be a band of 4 or 5. Immature birds seemed to prefer dense thickets.

Wing measurements 6 ♂ 152-162.5; 7 ♀ 140.5-152.5 mm.

Acrocephalus stentoreus brunnescens (Jerdon). The Indian Great Reed-Warbler.

A single specimen was collected, but several were seen in the grassy edging of a small stream near Supa.

Acrocephalus dumetorum Blyth. Blyth's Reed-Warbler.

One of the common birds, and found in most of the habitats. The series of collected specimens shows more olive, less brown, than birds in fresh fall plumage from Afghanistan, Baltistan and Ladakh.

Acrocephalus agricola agricola Jerdon. The Paddy-field Warbler.

A few birds stayed along the grassy border of a small stream running through rice fields near Londa. Elsewhere none were seen. They are like a topotypical specimen from Madras Presidency.

Wing measurements 4 ♂ 55-58.5 mm. 2=7-8, once 6-7.

Orthotomus sutorius londæ Koelz¹.

Tailor-birds occurred not uncommonly in pairs, usually in the dry scrub and along field borders.

Franklinia gracilis albogularis (Walden). The Coorg Wren-Warbler.

The species frequented the open forests and scrub jungle and flocks of about 10 were occasionally seen. I follow Whistler (*J.B.N.H.S.*, xxxviii, p. 468) in using Walden's name as a trinomial, assuming that my specimens are like those of Coorg.

Wing measurements 6 ♂ (43) 45-48.5; 5 ♀ 42-44 (47) mm.

Hippolais caligata annectans Sushkin.

A single specimen (wing 58 mm.) was taken in the scrub jungle on January 18 and though search was regularly made, no more were seen. This bird is darker than specimens I have from Sidhout and Kodur, in the Madras Presidency (topotypical *rama*), and from Sind and Punjab.

Phylloscopus tytleri (Brooks). Tytler's Willow-Warbler.

Occasional specimens seen; two collected.

Phylloscopus nitidus nitidus Blyth. The Green Willow-Warbler.

Recorded only three times, when specimens were taken: January 26, February 27 and March 11.

Wing measurements 2 ♂ 61, 61.5; ♀ 60 mm.

Phylloscopus nitidus viridanus Blyth. The Greenish Willow-Warbler.

A common element of the hunting parties. Specimens taken throughout the season are in worn plumage and some in February were moulting primaries.

¹ Walter Koelz, 'New Birds from Asia, Chiefly from India', *Proc. Biol. Soc., Washington*, 52, June 5, 1939, pp. 61-82.

Phylloscopus magnirostris Blyth. The Large-billed Willow-Warbler.

A rather rare species. Occurred usually in the heavy forest.
Wing measurements 2 ♂ 64; 5 ♀ 58.5-64.5 mm.

Phylloscopus occipitalis occipitalis (Blyth.). The Large Crowned Willow-Warbler.

A common element of the hunting parties. All specimens collected were males.

Wing measurements 17 ♂ 64-70 mm.

Irena puella puella (Latham). The Fairy Blue-bird.

A common bird of the forest, often with the hunting parties, and in the fig trees, eating the ripe fruits, along with Orioles, Barbets, *Piprisoma*, Fruit Pigeons, Starlings, Mynas, Hornbills, Bulbuls, *Turdus*. Often a half dozen or so occurred together.

Wing measurements 9 ♂ 123-129; 7 ♀ 117.5-126.5 mm.

A male taken on March 12 had testes enlarged to breeding condition.

Oriolus oriolus kundoo Sykes. The Indian Oriole.

Orioles were found commonly, feeding on the fruits of the various species of figs, and often also in the flowering *Bombax* trees.

Wing measurements 6 ♂ 135-147; 6 ♀ 133-143 mm.

Oriolus chinensis diffusus Sharpe. The Indian Black-naped Oriole.

A single female (wing 147 mm.) was collected on February 3. No others were seen.

Oriolus xanthornus maderaspatanus Franklin. The South Indian Black-headed Oriole.

Found usually in the scrub jungle and around clearings.

Fed less commonly on the figs than *O. o. kundoo*.

Wing measurements 10 ♂ 129-140; 2 ♀ 131 mm.

Eulabes religiosa indica (Cuvier). The Southern Grackle.

The species was not common till mid February, and thereafter flocks of 2-20 or so were often seen, usually in the fig- or *Bombax* trees. Specimens appear to be of the Ceylonese race.

Wing measurements 10 ♂ 137-146; 5 ♀ 136-140 mm.

Pastor roseus (Linnaeus). The Rosy Pastor or Rose-coloured Starling.

Pastors occurred in parties of half dozen, or even singly, mainly in the fields.

Wing measurements 4 ♂ 127.5-130.5; ♀ 123.5 mm.

Sturnia malabarica malabarica (Gmelin). The Grey-headed Myna.

Sturnia malabarica blythii (Jerdon). Blyth's Myna.

The species occurred in flocks, often of 25 or more, and were frequently seen in the flowering *Butea* trees. Most of the individuals collected belong to the race *blythii*.

Temenuchus pagodarum sylvestris (Hodgson).

Like the Rosy Pastors, this species kept to the fields. It occurred in small groups like that form, but was more often met. It fed in the *Bombax* often, but rarely in the fig trees.

Wing measurements 5 ♂ 106-110; 5 ♀ 99-104 mm.

Acridotheres tristis tristis (Linnaeus). The Common Myna.

In habits and abundance like the last, except that it was often seen eating figs. Specimens taken are not in fresh plumage and are lighter and more vinous than fresh Afghan birds.

Wing measurements 6 ♂ 148-153; 6 ♀ 139-147 mm.

Æthiopsar fuscus mahrattensis (Sykes). The Southern Jungle Myna.

Commoner than the last; common in the fig trees.

Wing measurements 6 ♂ 126-129; 5 ♀ 121-126 mm.

Ploceus philippinus travancorensis Whistler. The Travancore Baya or Weaver-Bird.

A single record: a male (wing 71 mm.) taken in a sugar cane patch on January 19.

Lonchura striata estriata Koelz¹.

This was a common bird in the open scrub jungle and in the fields. Flocks were met usually containing birds in mature and immature plumage, both usually in moult. Breeding specimens were, however, taken throughout our stay.

Lonchura punctulata lineoventer (Hodgson). The Spotted Munia.

This species also occurred in flocks of adult and juvenile birds and none of them were in stable plumage. Moult had usually just begun and in adults the primaries were much frayed. Clearings were the favorite habitats and the Lantana berries were approved food.

Wing measurements 10 ♂ 53-58; 8 ♀ 53.5-59 mm.

Erythrina erythrina kubanensis (Laubmann).

Common in flocks, of up to about 25, usually about clearings. They often fed on the blooms of *Butea frondosa*. I have seen an adult male of *kubanensis* from the Caucasus in the collection of the Museum of Comparative Zoology which fits into the series of specimens collected from Londa and from the mountain districts of the Punjab, Ladakh and Afghanistan. *Roseatus* is a more saturated form that breeds farther east and occurs in winter in the Nilgiris and Palnis.

Gymnoris xanthocollis xanthocollis (Burton). The Yellow-throated Sparrow.

Common in the scrub jungle and about the clearings. Breeding had begun in late February.

Wing measurements 10 ♂ 81-89; 6 ♀ 78-81 mm.

Passer domesticus indicus Jardine and Selby. The Indian House-Sparrow.

Except at Londa, there were few House Sparrows, probably because the native house architecture is too simple to afford them shelter.

Wing measurements 4 ♂ 70.5-74 mm.

Riparia rupestris (Scopoli). The Crag-Martin.

An occasional specimen was seen in the air near Castle Rock in early March.

Riparia concolor (Sykes). The Dusky Crag-Martin.

Seen in pairs, most often around railroad bridges.

Wing measurements ♂ 109; ♀ 107 mm.

¹ Walter Koelz, 'New Birds from Asia, Chiefly from India', *Proc. Biol. Soc., Washington*, 52, June 5, 1939, pp. 61-82.

Hirundo smithii filifera Stephens. The Indian Wire-tailed Swallow.

A common species, often seen in early morning on the telegraph wires beside a clearing. Breeding had begun in mid January.

Wing measurements 5 ♂ 112-118; 5 ♀ 111-114 mm.

Birds from North India and Afghanistan average larger. The intensity of head color is variable.

Hirundo daurica nipalensis Hodgson. Hodgson's Striated Swallow.

The commonest swallow. Large flocks often were hunting over the clearings or resting on the telegraph wires. Sometimes swarming ants would cause a congregation to spend hours over a forest area. Mostly the individuals taken were in various stages of moult.

Wing measurements 8 ♂ (105) 112-119; 4 ♀ 113-117.5 mm.

Hirundo daurica erythropygia Sykes. Sykes's Striated Swallow.

A female (wing 108 mm.) that appears to be of this race was taken on January 11.

Motacilla alba dukhunensis Sykes. The Indian White Wagtail.

Species of *Motacilla*, along with *Dendronanthus* and *Cyanosylvia* came in large numbers to roost in a small patch of sugar cane near Londa. The various forms probably came from afar because some of them were rarely seen during the day.

This was not a common Wagtail but one or a few could usually be found in some wet rice fields. Specimens taken in March were moulting to breeding dress.

Wing measurements ♂ 90.5; 5 ♀ 83.5-88 mm.

Motacilla alba personata Gould. The Masked Wagtail.

Rather rarer than the last.

Wing measurements ♂ 91; 3 ♀ 88 mm.

Motacilla maderaspatensis maderaspatensis Gmelin. The Large Pied Wagtail.

A common form, found in pairs, usually along the larger streams with open banks. March birds were breeding.

Wing measurements 7 ♂ 97-101.5; 6 ♀ 92-97.5 mm.

Motacilla cinerea caspica (Gmelin). The Eastern Grey Wagtail.

Found in such situations as frequented by the last, but singly or in pairs.

Wing measurements ♂ 84; 10 ♀ 78-82 mm.

Motacilla flava beema Sykes. The Indian Blue-headed Wagtail.

Rather common in the dry rice fields. A few of the specimens, all in winter dress, have a yellowish supercilium.

Motacilla flava thunbergi Billberg. The Grey-headed Wagtail.

Rather abundant in the roosting parties.

Wing measurements 2 ♂ 82 mm.

Motacilla citreola weræ Buturlin.

One of the commonest Wagtails. Specimens were mostly in immature plumage.

Wing measurements 7 ♂ 80-83; 2 ♀ 72, 78 mm.

Dendronanthus indica (Gmelin). The Forest Wagtail.

Abundant in the roosting parties and rather common in the open forest and along streams where a few could be flushed from the ground. Usually they were very shy in the day time.

Wing measurements 10 ♂ 79-83; 6 ♀ 76-81.5 mm.

Anthus trivialis trivialis (Linnaeus). The Tree-Pipit.

Flocks of up to about 10 individuals were common in the clearings. Most of the specimens taken were moulting.

Wing measurements 4 ♂ 86-90; 13 ♀ 83-86 (89) mm.

Anthus hodgsoni inopinatus Hartert and Steinbacher.

Common in flocks like the last, but in the scrub jungle, not in the openings.

Wing measurements 6 ♂ 84-88; 7 ♀ 80-85 mm.

Anthus rufulus malayensis Eyton. The Malay Pipit.

Common in pairs in the fields. Breeding had begun in early January.

Wing measurements 11 ♂ 80.5-84; 2 ♀ 79, 81 mm.

Anthus campestris godlewskii Taczanowski.

Seen only on the pasture plain at Jagalbed, where a flock of perhaps 20 arrived on March 9.

Wing measurements 3 ♂ 92-94 mm.

Galerida malabarica propinqua Koelz¹.

Common in pairs in the fields. Birds were breeding all during our stay, and on January 27 a full fledged young was collected.

Zosterops palpebrosa salimalii Whistler. The White-eye.

Not found until mid February when it was common in certain blooming trees in the scrub forest.

Wing measurements 10 ♂ 53-56; 4 ♀ 52-55 mm.

Leptocoma lotenia (Linnaeus). Loten's Sunbird.

Rare except in the scrub jungle around Castle Rock where breeding pairs were found in early March.

Wing measurements 3 ♂ 57-58.5; 2 ♀ 54, 55 mm.

Leptocoma asiatica brevirostris (Blanford). The Sind Purple Sunbird.

Common. They frequented the *Butea frondosa* blooms as well as the less showy flowers of forest trees, shrubs and climbers. Some specimens were breeding all during our stay and full fledged young were seen and collected. Some males taken were not yet in full plumage in early March and many were in full plumage on our arrival.

Wing measurements 16 ♂ 54.5-59; 8 ♀ 51-54.5 mm.

I have 16 males and 8 females from Londa, mostly in adult plumage, except that four of the January males are moulting to adult plumage and one March bird has not completed the change. Compared with 4 adult males and a female from Kalaigulaman, Afghanistan and a series from Sind (*brevirostris*), 11 males, including all the immature ones and 6 females (one juvenile) have bills that match closely in length and depth those of Sind and Afghanistan.

I have a pair of birds from Dacca, Bengal which should be *intermedia*, and a pair from Patna, Bihar, a male from Benares, U.P., and a female from near Darjeeling which may be like typical *asiatica*=Gurgaon. These birds have heavier, not longer bills, than the 6 males and a female from Londa that do not match the *brevirostris* just mentioned. I can see no color differences in the males of these groups, but the female from Dacca and that from Darjeeling are richer yellow below than any of the others, except juveniles from Londa. It may be that *brevirostris* is distinguished by a somewhat weaker bill and extends along the west coast of India, and that *intermedia* is separable by richer color of females, not males.

¹ Walter Koelz, 'New Birds from Asia, Chiefly from India', *Proc. Biol. Soc. Washington*, 52, June 5, 1939, pp. 61-82.

Leptocoma minima (Sykes). The Small Sunbird.

Common, and found like the last, except that it did not frequent the *Butea* trees. Specimens taken in mid February were breeding.

Wing measurements 14 ♂ 44-48; 9 ♀ 42.5-45.5 mm.

Leptocoma zeylonica (Linnaeus). The Purple-rumped Sunbird.

Found mostly in the scrub jungle and not so common as the two last.

Wing measurements 5 ♂ 54-56; 2 ♀ 54 mm.

Arachnothera longirostra vantlynei Koelz¹.

Rare. Breeding pairs were found in March in the heavy jungle of the river bottoms near Supa and Castle Rock.

Dicaeum concolor subflavum Stuart Baker. The Belgaum Flower-pecker.

A common bird feeding chiefly in the *Loranthus*. Specimens taken in early March were breeding. Whistler (*J.B.N.H.S.*, xxxvii, p. 284) is probably right in considering *subflavum* a synonym of *concolor*. These specimens are virtually topotypical and are like birds from the foothills of the Nilgiris, except possibly they are paler.

Wing measurements 6 ♂ 45-49; 11 ♀ 44-47 mm.

Piprisoma agile saturator Koelz¹.

Not uncommon. Fed on the flowers, like *Leptocoma asiatica*, but also on the figs. Specimens taken in early March were breeding.

Pitta brachyura brachyura (Linnaeus). The Indian Pitta.

Rare, though there were extensive habitats, apparently suitable.

Wing measurements 2 ♂ 108, 109 mm.

Picus chlorolophus chlorigaster Jerdon. The Southern Indian Small Yellow-naped Woodpecker.

Found singly or in pairs in the forest. Sometimes not met for several days.

Wing measurements 10 ♂ 120-127.5; 8 ♀ 120-127 mm.

Dryobates mahrattensis mahrattensis (Latham). The Southern Yellow-fronted Pied Woodpecker.

Not uncommon, in pairs, in the scrub jungle.

Wing measurements 6 ♂ 98-103; 3 ♀ 99-101 mm.

Dryobates hardwickii hardwickii (Jerdon). The Southern Indian Pigmy Woodpecker.

Rather common, singly or in pairs in the forest, often with the hunting parties.

Wing measurements 8 ♂ 74-77.5; 4 ♀ 75-78 mm.

Micropternus brachyurus jerdonii (Malherbe). The Southern Rufous Woodpecker.

Rather common, in pairs, in the forest. They were often seen attacking the paper nests of ant colonies in the bamboo.

Wing measurements 8 ♂ 126-131, 8 ♀ 125-130.5 mm.

Brachypternus benghalensis woodi Koelz¹.

Not uncommon, usually at the edge of clearings.

¹ Walter Koelz, 'New Birds from Asia, Chiefly from India', *Proc. Biol. Soc., Washington*, 52, June 5, 1939, pp. 61-82.

Dinopium javanense malabaricum Kinnear and Whistler. The Malabar Golden-backed Three-toed Woodpecker.

Found only in the heavy forest of the river bottoms. There it was not uncommon, singly or in pairs.

Wing measurements 4 ♂ 138.5-143; 3 ♀ 139-143 mm.

Chrysocolaptes guttacristatus socialis Koelz.

Probably the commonest and also most conspicuous woodpecker, usually found in pairs, or often in groups of up to 6, in the forest or scrub jungle. On February 23 a male in first plumage was taken.

Wing measurements 10 ♂ 152-159; 8 ♀ 152-162 mm.

Hemicircus canente cordatus Jerdon. The Malabar Heart-spotted Woodpecker.

Common, singly or in pairs in the scrub jungle.

Wing measurements 8 ♂ 92-97; 8 ♀ 88-93 mm.

Macropicus javensis hodgsonii (Jerdon). The Malabar Great Black Woodpecker.

Occasionally found in the clearings, or scrub jungle, singly or in pairs. The birds were not noisy and must often have been overlooked. Excavations probably made by them were common enough.

Wing measurements 4 ♂ 213-220; 2 ♀ 224, 226 mm.

Vivia innominatus (Hartert).

Rare, only 3 specimens observed. A female taken on January 30 was laying.

Wing measurements 3 ♀ 58-60 mm.

Thereiceryx viridis (Boddaert). The Small Green Barbet.

A common bird. They fed extensively on figs. Birds taken in late January were beginning to breed.

Wing measurements 6 ♂ 97-104; 5 ♀ (92) 100-102 mm.

Xantholæma hæmacephala confusa Koelz¹.

Not common and seen only in January when they were feeding on figs. Specimens taken were in breeding condition.

Xantholæma malabarica (Blyth). The Crimson-throated Barbet.

A common species, always to be found among the ripe figs. Breeding specimens were taken from mid January.

Wing measurements 9 ♂ 78-83.5; 4 ♀ 79-82 mm.

Penthoceryx sonneratii sonneratii Latham. The Banded Bay Cuckoo.

Not noticed until late February, when the call was occasionally heard. In March the birds were noisier and they called commonly in the heavy forest around Jagalbed.

Wing measurements 2 ♂ 121.5, 123.5 mm.

Eudynamis scolopaceus scolopaceus (Linnaeus). The Indian Koel.

Considered rare until March when their calls were heard frequently. The favourite habitat appeared to be mango trees in the clearings.

Wing measurements 3 ♂ 187-194; 3 ♀ 178.5-186 mm.

Rhopodytes viridirostris (Jerdon). The Small Green-billed Malkoha.

Rarely seen, then singly or in pairs. They frequented the openings with dense Lantana growths where pursuit of them was impossible.

Wing measurements ♂ 135 mm.

¹ Walter Koelz, 'New Birds from Asia, Chiefly from India', *Proc. Biol. Soc., Washington*, 52, June 5, 1939, pp. 61-82.

Centropus sinensis parroti Stresemann. The Southern Crow-Pheasant.

Rather common. Occurred usually in the thickets along clearings and along streams.

Wing measurements 8 ♂ 177-196; 3 ♀ 191-213 mm.

Psittacula krameri borealis Neumann. The Eastern Rose-ringed Paroquet.

Not common, the pairs or even small flocks were occasionally seen in the *Bombax* or *Butea* trees. Collected specimens have as large a wing as Punjab specimens, which Whistler (*J.B.N.H.S.*, xxxvii, p. 752) says should be called *borealis*.

Wing measurements 3 ♂ 175-178; ♀ 164 mm.; 9 adult ♂ 170-179 (186); ♀ 169 mm., from Sira, Hissar Dt. and Bhadwar, Kangra Dt.

Psittacula cyanocephala cyanocephala (Linnaeus). The Western Blossom-headed Paroquet.

Common. Often seen in the *Butea frondosa* where it fed on flowers and seeds. A female taken on February 14 had nearly all the body-feathers worn to the midrib, with no moult. A young male taken on March 4 shows only a few rosy feathers over the right eye. Breeding specimens were taken in late January. Collected specimens have longer tails than Ceylon birds, and are not so yellow below.

Wing measurements 5 adult ♂ 137.5-143.5; 6 ♀ 128-137.5 mm.

Psittacula columboides (Vigors). The Blue-winged Paroquet.

Not seen except in the extensive forests about Jagalbed. They often fed in the fig trees, but it was difficult to approach them.

Wing measurements 2 ♂ 143, 144; 4 ♀ 134-140 mm.

Coryllis vernalis rubropygius Stuart Baker. The Malabar Loriquet.

Not uncommon; most often seen in the fig trees. Pairs were usually found together. Specimens taken in March were breeding.

Wing measurements 12 ♂ 86-96; 4 ♀ 91-95.5 mm.

Coracias benghalensis indica Linnaeus. The Southern Indian Roller.

Not uncommon in the open country.

Wing measurements 5 ♂ 179-183; 3 ♀ 176-179 mm.

Merops orientalis orientalis Latham. The Common Indian Bee-eater.

Common in the open country, often in pairs or small flocks.

Wing measurements 5 ♂ 93-96.5; 9 ♀ 90-92.5 mm.

Merops superciliosus javanicus Horsfield. The Blue-tailed Bee-eater.

Rather common in the river bottoms where they hunted from the tips of tall bamboos or dry trees. The birds were usually in parties of up to half dozen.

Wing measurements 3 ♂ 131-134; 5 ♀ 120.5-126.5 mm.

Merops leschenaulti leschenaulti Vieillot. The Chestnut-headed Bee-eater.

Found with the last, likewise in parties; probably more numerous.

Wing measurements 7 ♂ 105-110.5; 8 ♀ 104-107.5 mm.

Alcemerops athertoni athertoni (Jardine and Selby). The Blue-bearded Bee-eater.

Seen but three times, singly, always in the heavy timber.

Wing measurements ♂ 135 mm.

Ceryle rudis leucomelanura Reichenbach. The Indian Pied Kingfisher.

Frequented the large streams, such as the Crocodiles lived in. As Kingfishers go, not rare. Specimens of late January had sex organs in breeding condition. The plumage is somewhat worn but it seems that the amount of

white is probably as in the typical Ceylonese form. The black is not so sooty as in the Travancore race *travancoreensis*.

Wing measurements 4 ♂ 134-138; 3 ♀ 140-145 mm.

Alcedo atthis bengalensis Gmelin. The Common Indian Kingfisher.

Alcedo atthis taprobana Kleinschmidt.

Found along the streams, large and small, open or in the heavy forest. Of 15 specimens collected only 3 belong to the richly-coloured race, *taprobana*, unless they should be immature.

Wing measurements 7 ♂ 68.5-71; 3 ♀ 69.5-71 mm. and 3 ♂ 68-71.5 mm., respectively.

Alcedo meninting asiatica Swainson. Beavan's Kingfisher.

Rather uncommon. Found almost exclusively along the streams in heavy cover.

Ceyx tridactylus tridactylus (Pallas). The Three-toed Kingfisher.

Found only in the heavy forest along nearly dry trickles where it fed on crustaceans, etc.

Wing ♂ 56, 2 ♀ 58.5 mm.

Specimens appear indistinguishable from those from Sikkim, Malay and Hainan.

Ramphalcyon capensis gurali (Pearson). The Brown-headed Stork-billed Kingfisher.

Found along the larger more open streams. One of the common Kingfishers.

Wing measurements 3 ♂ 147-153; 3 ♀ 155-162.5 mm.

Halcyon smyrnensis fusca (Boddaert). The Indian White-breasted Kingfisher.

A common Kingfisher, found in fish-producing waters more frequently than usual.

Wing measurements 7 ♂ 115.5-123.5; 8 ♀ 118-124 mm.

Halcyon pileata Boddaert. The Black-capped Kingfisher.

Rare and found only in growing ricefields around Supa.

Wing measurements 2 ♂ 131.5, 132 mm.

These specimens average somewhat darker than Chinese birds.

Dichoceros bicornis (Linnaeus). The Great Indian Hornbill.

A single specimen was seen at Jagalbed on February 25.

Hydrocissa coronatus (Boddaert). The Malabar Pied Hornbill.

Not rare in the heavy timber, often in flocks of 20 or so, when feeding or roosting. They were often noisy and always shy.

Wing measurements ♂ 332; 3 ♀ 290-309 mm.

Tockus birostris birostris (Scopoli). The Common Grey Hornbill.

One was collected and one other seen.

Wing measurements ♀ 202 mm.

Tockus griseus griseus (Latham). The Malabar Grey Hornbill.

Common, in pairs, usually in the lighter, drier forests. They fed heavily on the various figs. When travelling they were often noisy. Their call is like crazy laughter.

Wing measurements 2 ♂ 211, 218; 8 ♀ 185-193 mm.

Upupa epops epops Linnaeus. The European Hoopoe.

Two females were collected, one February 24, one March 7.

Wing measurements 139.5, 144 mm.

Upupa epops ceylonensis Reichenbach. The Ceylon Hoopoe.

Rather rare, usually in pairs. February birds showed swelling gonads.
Wing measurements 6 ♂ 122-142; ♀ 122 mm.

Harpactes fasciatus malabaricus (Gould). The Malabar Trogon.

Common, usually in pairs, in the dry forest.
Wing measurements 9 ♂ 123-129; 6 ♀ 123-131 mm.

Apus melba. The Alpine Swift.

Large flocks passed regularly over the town of Londa, headed south, at about 8.30 a.m. They were usually out of gun range and none were ever taken.

Indicapus sylvaticus (Tickell). The White-rumped Spinetail.

Rather local and in small colonies. They were nesting in February in holes in dead palms (*Caryota urens*).
Wing measurements ♂ 113; 4 ♀ 112-116 mm.

Hemiprocne coronata (Tickell). The Indian Crested Swift.

Not uncommon. Seen hawking over the fields with the swallows or travelling in the higher strata.
Wing measurements 3 ♂ 146-155; ♀ 157.5 mm.

Caprimulgus macrourus atripennis Jerdon. Jerdon's Long-tailed Nightjar.

Rather common. Seen most often at night sitting on the ground in the fields. In the day time specimens were most often found on the ground in the scrub jungle.

Wing measurements 4 ♂ 170-181; 3 ♀ 175-186 mm.

Caprimulgus indicus indicus Latham. The Indian Jungle Nightjar.

About like the last.
Wing measurements 6 ♂ 182-191.5; 5 ♀ 185-191.5 mm.

Caprimulgus monticolus monticolus Franklin. Franklin's Nightjar.

Commonest of the Goatsuckers and found with the others.
Wing measurements 6 ♂ 187-201.5; 12 ♀ 182.5-196 mm.

Tyto alba crypta Koelz¹.

Only 3 specimens seen, taken from under a railroad bridge on January 26, 27 and 29.

Wing measurements 2 ♂ 262, 297; ♀ 293 mm.

Strix indranee indranee Sykes. The Brown Wood-Owl.

Found only in the heavy forest. Only one specimen was obtained.

Ketupa zeylonensis zeylonensis (Gmelin). The Ceylon Brown Fish-Owl.

A common species that was usually found in pairs. Food consisted mainly of fish and crustaceans, but one individual had eaten a small mammal.

Wing measurements 7 ♂ 355-398; 3 ♀ 370-379 mm.
These skins appear as dark as Ceylonese.

Bubo bengalensis (Franklin). The Indian Great Horned-Owl.

One could be heard calling occasionally at night but none were ever seen.

¹ Walter Koelz, 'New Birds from Asia, Chiefly from India' *Proc. Biol. Soc., Washington*, 52, June 5, 1939, pp. 61-82.

Otus bakkamœna bakkamœna Pennant. The Ceylon Collared Scops Owl.

Around Jagalbed in late February and early March birds could be heard commonly, but they kept to the bamboos and few were seen.

Wing measurements ♀ 148 mm.

Otus sunia rufipennis (Sharpe). The Indian Scops Owl.

Probably commoner than the last. At Jagalbed sometimes four could be heard from camp. They began singing in late January. They often sang from the mango trees and sometimes could be heard in the day time in the bamboo.

Wing measurements ♂ 127 mm.

Glaucidium radiatum. The Jungle Owlet.

Not common, but after January one could be heard almost every night. In March they began to sing in the day time. Two males were taken (wing 131 mm.). They are intermediate in color between *radiatum* and *malabaricum*.

Sarcogyps calvus (Scopoli). The Black Pondicherry or King Vulture.

Occasionally seen at camp, attracted by refuse. Usually single individuals came, sometimes 3. They were shy and only one was killed.

Gyps fulvus fulvescens Hume. The Indian Griffon Vulture.

Observed only at Jagalbed when on February 18 some 50 had gathered at a carcass. One was collected.

Pseudogyps bengalensis (Gmelin). The White-backed or Bengal Vulture.

The common Vulture that always came to camp for bird meat. One was preserved.

Neophron percnopterus (Linnaeus). The Egyptian or Large White, Scavenger Vulture.

Rare and only an occasional individual was seen; none killed.

Falco tinnunculus objurgatus Stuart Baker. The Indian Kestrel.

Kestrels were not common but an individual or two could usually be found in a day's walking, usually in large clearings. Of four pairs collected, all but one male may be referable to the heavily-barred race *objurgatus*. The exception may be *tinnunculus*. Food of four specimens was insects, mainly Orthoptera. Two had eaten skinks.

Wing measurements 4 ♂ 233-248; 4 ♀ 247-263 mm.

Aquila rapax vindhiana Franklin. The Indian Tawny Eagle.

Judged by experience in Sind and the Punjab, the bird was rare. Occasionally one came to camp and sometimes 2 or 3 could be seen soaring. Only one was killed.

Aquila clanga Pallas. The Greater Spotted Eagle.

Rare. Only one taken.

Lophotriorchis kienerii kienerii (Sparre). The Rufous-bellied Hawk-Eagle.

Only one specimen seen, one taken on February 21. It flew out to pick up a bird. The feathers of one were found around a village later.

Spizaetus cirrhatus ceylanensis (Gmelin). The Ceylon Crested Hawk-Eagle.

Not common and usually very shy. Male taken on January 21, wing 384 mm.

Spilornis cheela melanotis (Jerdon). The Crested Serpent Eagle.

One of the commonest hawks. Often a pair stayed together. The birds sometimes were seen soaring about, high up, but more often came to notice from their habit of screaming when perched on some high vantage point.

They never screamed when resting in dense foliage. Is it possible that snakes respond to the vibrations of their cry? Food of specimens taken was often snakes, but as often skinks, once a large grasshopper and once a large mantis. A male taken on March 9 had testes in breeding condition. Only one bird in immature whitebreasted plumage was taken.

Wing measurements 6 ♂ 411-430; 6 ♀ 405-431 mm.

Butastur teesa (Franklin). The White-eyed Buzzard-Eagle.

A common species, found most often about the fields. Specimens taken were adults and birds in immature plumage. Food was most often frogs or skinks. One had eaten mice.

Wing measurements 7 ♂ 279-291; 9 ♀ 288-317 mm.

Haliastur indus indus (Boddaert). The Brahminy Kite.

Not common. I have found the species most commonly in marshes or pools. and such habitats about Londa were rare. Specimens taken had eaten mostly shrimps and frogs, but one had eaten an *Ardeola grayii*.

Wing measurements ♂ 391; 4 ♀ 378-414 mm.

Milvus migrans goviada Sykes. The Common Pariah Kite.

Common. One collected, ♀ wing 419 mm.

Milvus migrans lineatus (Gray). The Black-eared Kite or Large Indian Kite.

Three females were taken, wing 459, 491, 510 mm.

Elanus caerulescens vociferus (Latham). The Black-winged Kite.

Rather rare. An occasional specimen was found where there was a high dead limb to perch on in a clearing growing up to bushes.

Wing measurements ♂ 257; 2 ♀ 268, 270 mm.

Circus macrourus (S. G. Gmelin). The Pale Harrier.

Rather common. Harriers of all species were seen hunting over the fields or resting in the trees at their edge. Specimens collected had no food or had eaten birds.

Wing measurements 2 ♂ 325, 355; 6 ♀ 355-370 mm.

Circus pygargus Linnaeus. Montague's Harrier.

A single specimen taken, ♀, wing 379 mm. Food: grasshoppers.

Circus melanoleucos (Pennant). The Pied Harrier.

A single specimen, ♂ in immature dress, was taken.

Wing 344 mm. Food insects.

Circus æruginosus æruginosus (Linnaeus). The Marsh-Harrier.

Not so common as *C. macrourus* and seen most often around the wet fields near Supa.

Wing measurements juv. ♂ 393; ad. ♀ 395 mm.

Accipiter badius dussumieri (Temminck). The Indian Shikra.

Rather common. Found usually in the clearings, most often along streams, where it fed on insects and skinks. Only one specimen had eaten birds: a *Munia*. In late February birds with sex organs in breeding condition were collected.

Wing measurements 12 ♂ 173-199; 9 ♀ 199-209 mm.

Accipiter trivirgatus trivirgatus (Temminck). The Crested Goshawk.

Not uncommon, usually in the forest where it was oftenest found perched in a tree. All specimens taken had eaten only birds. One had eaten a *Gallus sonneratii* cock and one a *Galloperdix*.

Wing measurements 2 ♂ 202, 210; 6 ♀ 225-237 mm.

In size the specimens are apparently intermediate with *rufitinctus*.

Accipiter nisus nisosimilis (Ticell). The Asiatic Sparrow-Hawk.

Rare.

Wing measurements 2 ♂ 202, 212; ♀ 250.5 mm.

Accipiter virgatus besra Jerdon. The Southern Besra Sparrow-Hawk.

Of the same habitat preferences as *A. trivirgatus*, but not found so commonly.

Wing measurements ♂ 158.5; 3 ♀ 185-188 mm.

Pernis ptilorhynchus ruficollis Lesson. The Indian Crested Honey-Buzzard.

Probably not uncommon in the heavy forest. Four specimens taken differ in plumage, and vary from the form with dark underparts to the form with white streaked underparts. These can be matched phase for phase in a series of skins from the Kangra District, Punjab, and it may be that the various stages of plumage reflect age. Food: bees, larvae, comb, are usual. Three birds taken in March were breeding.

Wing measurements 2 ♂ 403, 419, 2 ♀ 420, 421 mm.

Crocopus phoenicopterus chlorigaster (Blyth). The Southern Green Pigeon.

Rare. Pairs were seen on three occasions in late January, all breeding birds. They fed on fig fruit, as did all the other Fruit Pigeons.

Wing measurements 2 ♂ 183, 190; ♀ 178.5 mm.

Dendrophassa pompadora affinis (Jerdon). The Grey-fronted Green Pigeon.

The commonest of the Fruit Pigeons. In favourable fig trees flocks of 20-30 congregated to feed on the fruits, specimens taken in late January were breeding.

Wing measurements 10 ♂ 137.5-147; 5 ♀ 142-149 mm.

Ducula badia cuprea (Jerdon). Jerdon's Imperial Pigeon.

A single bird (♀, wing 218 mm.), was noted.

Muscadivora ænea pusilla (Blyth). The Ceylon Imperial Green Pigeon.

Common in the heavy forest. Flocks of up to 25 used to feed in certain lofty trees. I never saw them eating figs. They were shy when feeding and could usually be killed only when flying to feed in the morning. One specimen in mature plumage dissected almost immediately on killing had no trace of sex organs. Specimens are intermediate in size with *sylvatica*.

Wing measurements 3 ♂ 222-226; 6 ♀ 213-225 mm.

Chalcophaps indica indica (Linnaeus). The Indian Emerald Dove.

Not rare in the heavy forest. They were oftenest seen as pairs or individuals feeding on the forest roads. Specimens taken average more bronzed than those from Malay and east.

Wing measurements 3 ♂ 146-154; 5 ♀ 135-148 mm.

Streptopelia orientalis meena (Sykes). The Indian Rufous Turtle-Dove.

Common. During the warm part of the day small flocks stayed together, usually in the mango trees along streams. They fed mornings and afternoons in the dry ricefields and were always shy. Specimens taken resemble breeding birds of Lahul, Punjab.

Wing measurements 8 ♂ 185-193; 8 ♀ 179-195 mm.

Streptopelia orientalis sylvicola Koelz¹.

This race was found only in the Castle Rock area where they were breeding in country covered with thick evergreen bushes and feeding with the preceding in the rice fields.

¹ Walter Koelz, 'New Birds from Asia, Chiefly from India' *Proc. Biol. Soc., Washington*, 52, June 5, 1939, pp. 61-82.

Streptopelia chinensis suratensis (Gmelin). The Indian Spotted Dove.

Common. Flocks were often seen feeding in the rice fields. Collected specimens are in juvenile plumage, or are adults, the last for the most part breeding.

Wing measurements 5 adult ♂ 130.5-145; 5 juvenile ♂ 126-133; 9 adult ♀ 127-137.5; 4 juvenile ♀ 129-134 mm.

Pavo cristatus Linnaeus. The Common Peafowl.

The natives said peafowl occurred in certain places in the district but we saw no evidence of them.

Gallus sonneratii Temminck. The Grey Jungle-Fowl.

Common, singly or in small groups, and exceedingly wary around human habitations. Only along the road through the heavy forest was it possible to collect specimens at all easily.

Wing measurements 6 ad. ♂ 225-247; 3 ♀ 187-196 mm.

Galloperdix spadicea spadicea (Gmelin). The Red Spur-Fowl.

Common, in pairs; wary. Spurfowls keep to more open country than the junglefowls and were most often seen in the scrub.

Wing measurements 6 ♂ 147-156; 4 ♀ 141-151 mm.

Perdica asiatica vidali Whistler.

Common in small flocks in the grassy scrub.

Wing measurements 8 ♂ 83.5-99; 3 ♀ 80-83 mm.

Amaurornis phoenicurus phoenicurus (Pennant). The White-breasted Water-Hen.

Commonly seen along the small streams. When disturbed they either ran for cover or flew into a thick bamboo and climbed about in the interior.

Metopidius indicus (Latham). The Bronze-winged Jacana.

One was collected at a little weedy pool near Londa on February 14.

Gallinula chloropus indicus Blyth. The Indian Moorhen.

One was taken on the pool mentioned above on February 4.

Burhinus oedipnemos mayri Koelz¹.

Stone-Curlews were constantly in evidence at night from their call, when they came to feed in the clearings. They apparently hunted beetles around the cattle-dung. During the day they were seldom seen. In January individuals or even small flocks could occasionally be found resting on the outcrop-rocks of certain bushy knolls and the natives said that they regularly congregated at such places in the winter. In February they had segregated into pairs and then were secretive. A female taken on March 12 was laying. They apparently nest in the scrub jungle.

Charadrius dubius curonicus Gmelin. The European Little Ringed Plover.

A few individuals were occasionally seen in the growing ricefields.

Wing measurements ♂ 109.5; 2 ♀ 113 mm.

Lobivanellus indicus indicus (Boddaert). The Indian Red-Wattled Lapwing.

Rather common, usually in pairs, in the clearing. Sometimes they were also found on the rock outcroppings frequented in winter by *Burhinus*.

Wing measurements 4 ♂ 218-229; 4 ♀ 212-232 mm.

¹ Walter Koelz, 'New Birds from Asia, Chiefly from India' *Proc. Biol. Soc., Washington*, 52, June 5, 1939, pp. 61-82.

Lobipluvia malabarica (Boddaert). The Yellow-wattled Lapwing.

Found only on the pasture plain at Jagalbed where several pairs were breeding.

Tringa ochrophus Linnaeus. The Green Sandpiper.

Found not uncommonly along the streams and standing water.

Tringa glareola Linnaeus. The Wood-Sandpiper.

Found most often in the growing rice, and there not uncommon.

Tringa hypoleucos (Linnaeus). The Common Sandpiper.

Common along the streams. A specimen taken had albinistic primaries on both wings.

Scolopax rusticola indica Hodgson.

Borings were common along the soft banks of certain streams and absent on others. On February 10, 2 birds were collected along one of these favourable streams and thereafter no more came. The only sight records that do not concern these specimens were made on February 10 and 28, March 10, when single birds were seen at widely separated localities.

These specimens and others that I have seen from the Nilgiris and the Kangra District of Punjab, differ sufficiently in my opinion, to be recognized subspecifically and I think that Hodgson's name *Scolopax indicus* (J.A.S.B., vi, 1837, p. 496) of Nepal, should be used for them. The Indian birds are darker, especially above, and have more black in the markings. The feet average heavier.

Capella stenura (Bonaparte). The Pintail Snipe.

Rather common in the rice fields.

Wing measurements 5 ♀ 127-136 mm.

Phalacrocorax niger (Vieillot). The Little Cormorant.

Not rare along the larger streams.

Wing measurements 2 ♂ 202, 204 mm.

Anhinga melanogaster Pennant. The Indian Darter or Snake-bird.

Like the last. No specimens taken.

Pseudibis papillosus (Temminck). The Indian Black Ibis.

A single specimen was seen on March 10.

Dissoura episcopa episcopa (Boddaert). The White-necked Stork.

Not rare; singly or in small groups; shy.

Wing measurements ♂ 481; 2 ♀ 480, 482 mm.

Leptoptilos javanicus (Horsfield). The Smaller Adjutant.

Two individuals were feeding in a ricefield on February 20. No others were seen.

Ardea cinerea Linnaeus. The Common Grey Heron.

Occasional individuals were seen along the larger streams, but they were too shy to approach.

Egretta intermedia intermedia (Wagler). The Indian Smaller Egret.

A flock of about 30 stayed in a ricefield near Castle Rock. Elsewhere only stragglers were seen.

Wing measurements ♂ 293 mm.

Egretta garzetta garzetta (Linnaeus). The Little Egret.

Rather rare and seen only singly.

Wing measurements 2 ♂ 271, 275 mm.

Bubulcus ibis coromandus (Boddaert). The Cattle Egret.

Not rare, attending the pasturing flocks on suitable plains.

Wing measurements ♂ 250; 3 ♀ 237-240 mm.

Ardeola grayii (Sykes). The Indian Pond-Heron.

Common, and found wherever there was water. Since puddles and pools were rare, the birds frequented running water more generally than they usually do.

Wing measurements 5 ♂ 209-224; ♀ 190.5 mm.

Butorides striatus abbotti Oberholser.

Not rare, along the larger streams.

Wing measurements 4 ♂ 172-176; 4 ♀ 166-169 mm.

On the basis of these measurements, the form might be considered *javanicus* (wing 165-180 mm.) but I find on comparison with specimens from the Java region that in the latter males have light markings reduced and duller, and females have a smaller white wing-spot and whiter underparts.

Ixobrychus cinnamomeus (Gmelin). The Chestnut Bittern.

Rather rare. Two specimens taken, and four others seen.

“NEW BIRDS FROM ASIA, CHIEFLY FROM INDIA¹”.

Under the above title Mr. Walter Koelz has described 63 new races in the Proceedings of the Biological Society of Washington, Vol. 52, pp. 61-82 (5 June, 1939) of these new races 17 are described from Afghanistan and 44 from India so the paper should be of considerable interest to Ornithologists in India. Unfortunately a perusal of the paper leads to considerable disappointment as it is evident that Mr. Koelz has not had access to sufficient material to enable him to discriminate between good and bad races.

As these new forms have been described, named and published it is necessary to take notice of them. I have therefore been carefully through them and it may be of interest to record the results of my examination of the 44 new Indian races. These will be examined in detail but before doing this it may be well to make two preliminary observations.

The first is that of the 44 new races no less than 17 are given type localities at Londa, Jagalbed and Castle Rock, places which lie just inland from Goa. This area was already well known owing to the papers on the South Konkan by Vidal (Stray Feathers ix, pp. 1-96), on Belgaum by Butler (S. F. ix pp. 367-442) and North Kanara by Davidson (J.B.N.H.S., x, pp. 652-679), xii pp. 43-71 and good collections made in these areas by these gentlemen are in the British Museum. The triangle, roughly 15 miles on a side, formed by lines joining Londa, Supa and Castle Rock, which includes the type localities of the 17 forms is ornithologically intermediate in character marking the transition of the South Indian and the South-western humid mountain forms into the North Indian and drier Deccan forms.

The second point to make is that Mr. Koelz makes no attempt to define the distribution of his new forms. He fixes a type locality and sometimes mentions another locality or two where other specimens were obtained. Had he completed his work and attempted to define the distribution of his races he would have soon discovered how few of them could stand.

Now to comment on the new forms:—

P. 61. **Parus major stupae** (type locality Sanchi, Bhopal).

It is quite correct that birds from Peninsular India should be separated from *P. m. mahrattarum* (Ceylon).

¹ We publish comments by Mr. H. Whistler on the new races of Indian birds described by Mr. W. Koelz, some of which are referred to in the paper printed above.—EDS.

Mr. Koelz has, however, overlooked the essential differences: *stupae* differs from *mahrattarum* in being brighter and paler above, the white edging to the tertiaries is much broader and the bill is not so large.

P. 63. *Machlolophus xanthogenys xanthonotus* (Londa).

This is merely the intermediate between *M. x. aplonotus* and *M. x. travancorensis* and is not a recognisable race. These 2 forms intergrade along the western coast of India and birds from N. Kanara and Belgaum (between which Londa is situated) go best with *travancorensis*, whereas from Mahableshwar northwards the form is clearly *aplunotus*; *xanthonotus* can be relegated to the synonymy of *travancorensis*.

P. 63. *Sitta frontalis simplex* (Londa).

I have recently compared good series of this Nuthatch from various localities in Peninsular India with topotypes from Ceylon and can find no recognisable difference. *Simplex* is merely a synonym of *frontalis*.

P. 63. *Ægithina tiphia septentrionalis* (Bhadwar, Kangra).

This form is separable on the differences given.

P. 64. *Iole icterica intensior* (Kunjapani, Nilgiri Hills).

I have carefully examined this species for races on several occasions, comparing birds from Ceylon, Travancore, Nilgiris, Mysore, Kanara and Mahableshwar. There are no races and the differences alleged for this race are not constant.

P. 65. *Saxicola caprata rupchandi* (Londa).

This must become a synonym of *burmanica*, which is itself a synonym of the typical race. I have examined specimens from north, south and west of Londa and from as close to it as Belgaum and all are clearly the same. The differences alleged are merely individual.

P. 66. *Cercomela fusca ruinorum* (Sanchi, Bhopal State).

I have recently examined specimens from Jaithari, near Sanchi and could find no difference in size or colour from birds from the Punjab. This species has no races, nor would one expect them from its limited distribution.

P. 66. *Saxicoloides fulcata lucknowensis* (Lucknow).

I have not actually seen specimens of this bird from Lucknow, but they must be the same as those from Etawah, Futtehghar, Benares and Moghulserai, other similar localities in the United Provinces from which there are specimens in the British Museum. These are all *S. f. cambaiensis* and *lucknowensis* will become a synonym of that name. It is evident that Mr. Koelz has not allowed for the considerable variation induced by wear and bleaching in this form.

P. 67. *Saxicoloides fulcata stuartbakeri* (Bodhgaya, Bihar).

Two males from Rognathpur and Lohardugger (wings 72-73.5 mm.) and two females from Maunthum (wings 70-71 mm.) in the British Museum are also small compared with north-western birds (10 ♂ Punjab; with 73-81, 12 ♀, wing 71-76.5 mm.). As this is the north-easterly limit of the distribution of this species in India the recognition of this race may be useful though its limits will be very difficult to define.

P. 67. *Muscicapa strophilata euphonia* (Kulu).

This race is recognisable, west Himalayan birds being definitely paler than East Himalayan specimens. I noted the point some years ago but wanted to confirm it with more, fresh material.

•P 68. *Hyphothymis azurea similis* (Londa).

There is a good series of this flycatcher in the British Museum from the whole of its distribution in western Peninsular India, and it is clear that it

cannot be divided into 2 races in that area. Mr. Koelz's name must therefore become a synonym of *H. a. sykesi* (Dukhun) even if he does not agree with my action (*J.B.N.H.S.*, xxxvi, p. 91) in holding that *sykesi* is a synonym of *styani* (Hainan).

P. 68. *Chelidorhynx hypoxantha noa* (Naggar, Kulu).

I have several times examined good series of this species for east and west Himalayan races, and though I agree it would be possible to select specimens to illustrate the differences cited by Mr. Koelz they are not sufficiently constant to warrant the recognition of two races.

P. 68. *Leucocirca albicollis canescens* (Bhadwar).

The remarks made under the last species apply again here.

P. 69. *Hemipus picatus insulæ* (Wavenden, Ceylon).

This is an excellent race in that the female has a black back like the male and not a brown back as in the typical South Indian form. Mr. Koelz's name is however antedated by *Hemipus picatus leggei* Whistler, Bull, B.O.C. vol. lix no. cccxxii (15 May 1939) p. 101.

P. 69. *Tephrodornis pondiceriana warei* (Londa).

I have already discussed the position regarding the races of this somewhat variable species (*J.B.N.H.S.*, xxxviii, p. 309) and shewn that the typical form is itself a variable intermediate. No good purpose can be attained by subdividing the intermediate again and this name can only be a synonym of the typical form. Mr. Koelz would be puzzled to define a range for his new form.

P. 69. *Pericrocotus cinnamomeus sidhoutensis* (Sidhout, Madras Presidency).

The question of the name and races of this interesting and variable bird has already been dealt with at some length (*J.B.N.H.S.*, xxxvi, p. 343), and the original reference may be consulted as too long to repeat here. Specimens from Kodur and the Cumbum Valley (south and north of Sidhout) were obtained in the E. ghats Survey and they were referred under the above argument to the typical race *Pericrocotus peregrinus peregrinus* of which I propose to consider this name a synonym.

P. 70. *Chibia hottentota londæ* (Londa).

This is a recognisable form on its smaller size compared with Sikkim birds.

P. 70. *Orthotomus sutorius londæ* (Londa).

I have examined specimens from Ahmednagar, Matheran, Mahableshwar and Belgaum on the one side of Londa, and from various localities in Mysore on the other and could detect no difference between them. All appeared to me to agree with *guzerata* and with Sykes' Deccan types of *venneti* and *lingoo* which would in any case antedate Mr. Koelz's name.

P. 71. *Orthotomus sutorius sindiana* (Hyderabad, Sind).

Ticehurst (*Ibis*, 1922, p. 551) compared fresh Sind specimens with topotypes and could find no difference, but as he pointed out the fact was not surprising as in Sind this species does not come under the influence of desert conditions.

P. 72. *Prinia sylvatica palniensis* (Kodaikanal, Palni Hills).

This is the first record of the Jungle Wren-Warbler from the Palni Hills, but Mr. Koelz in citing his paratypes from Kodaikanal and Ootacamund admits that the Palni and Nilgiri birds are the same. The new name is therefore merely a synonym for the typical race of which the type locality is the Seegore Pass, Nilgiris. Jerdon's words 'I have only seen this species hitherto in open forest jungle in the Seegore pass of the Nilgiris' (Madras Journal Lit. Sci.,

vol. xi, 1840, p. 4) are explicit and it is not open to Mr. Koelz to underline the word *hitherto* as he has done) and then say that 'it seems likely then that Jerdon's description refers rather to the race in the surrounding lowland than to the Nilgiri race and the former may be considered typical *sylvatica*'. I have seen no evidence in any case to suggest that this species varies according to altitude and the alleged differences are not impressive.

P. 73. *Prinia sylvatica mahendrac* (Mahendra Giri, Orissa).

I have not seen enough material of this warbler from N.-E. India to comment on this name with confidence but Mr. Koelz has not explained how this new race is to be distinguished from *P. s. gangetica* to which one would rather expect it to belong and to which the description might easily apply.

P. 72. *Oriolus oriolus baltistanicus* (Sagoni, Baltistan).

Specimens from Baltistan in my own collection are not separable from *O. o. kundoo*. One would not expect them to differ as Turkistan birds are also *kundoo*. The differences alleged for the new race are merely individual.

P. 73. *Lonchura striata estriata* (Jagalbad).

There is a good series of this *Munia* in the British Museum including one of Fairbank's birds from the Goa frontier, and others from the north and South of the type locality of the new subspecies. These show that South Indian birds as a whole, including the area under discussion, cannot be separated from the typical race of Ceylon.

P. 74. *Erythrina rubicilla ebilis* (Puga, Rupshu).

Specimens from Puga were examined by Hellmays (*F.M.N.H. Publ.* 263, 1929 p. 47) and found to be perfectly typical specimens of *severtzovi*. Other specimens collected in Ladakh by Henderson, Osmaston, Meinertzhagen and Landlow and a series collected by myself in Spiti and Lahul have all been critically examined by various workers and found to be identical with Turkestan birds so it is evident that this new race is not recognisable.

P. 75. *Anthus hodgsoni burzil* (Burzil Pass).

I would hazard a guess that this will prove to be a synonym of *Anthus trivialis haringtoni* which possesses the character of the new race, a heavy bill. At any rate Osmaston and I obtained *haringtoni* on the Burzil Pass at 12,000 ft. on 26 July 1928 and found it common in that area, whereas *Anthus hodgsoni* has not been reliably reported west of Chamba and the Duale Shar, nor in Lahul from where Koelz quotes his paratypes.

P. 75. *Motacilla maderaspatensis kangrae* (Bhadwar, Kangra).

My own collection contains a series of this wagtail from Kangra and other Punjab localities, but neither Dr. Ticehurst nor I have been able to separate them from the typical form.

P. 76. *Mirafra cantillans bangsi* (Hospet, Madras Presidency).

Neither the material in the British Museum nor my own collection nor the few specimens I have seen from other sources allow me to comment on this form.

P. 76. *Galerida malabarica propinqua* (Londa).

There is a large series of this lark in the British Museum, including specimens from Belgaum, close to Londa, and from both north and south of Londa and this series shows that no race can be separated for the Londa area. The breeding season of this lark is not a clearly defined one and individuals may be in a different state of wear at the same time, such wear affecting their appearance greatly.

P. 76. *Zosterops palpebrosa palniensis* (Kodaikanal, Palni Hills).

I have not actually examined specimens of the White-eye from the Palnis but these hills are only a spur of the Travancore ranges and all bird's from

the latter are identical with *nilgiriensis*. As it is incredible that one spur should contain a peculiar race of this active and generally distributed little bird this name is doubtless a synonym of *nilgiriensis*.

P. 77. *Arachnothera longirostra vantlynei* (Jagabhad).

The type locality of *Certhia longirostra* Latham is 'Bengal' later restricted by Stuart Baker (*J.B.N.H.S.*, xxviii p. 124) to Sylhet; the Malay specimens cited by Mr. Koelz in his diagnosis are therefore irrelevant, and his separation of a Peninsular Indian race is based on comparison with one specimen from N. India. A comparison of a proper series from N. India and the Peninsula would have shown him that there is no difference either of colour or size.

P. 77. *Piprisoma agile saturator* (Londa).

There are 3 specimens from Belgaum, close to Londa, in the British Museum and these are quite inseparable from the birds of the rest of the Peninsula. The amount of streaking is a question of individual variation.

P. 77. *Pitta brachyura pulchra* (Bhadwar, Kangra).

In separating this supposed Himalayan race from Ceylon topotypes, Mr. Koelz has overlooked the fact that this *Pitta* is a summer visitor to the sub-Himalayan area and a winter visitor to Ceylon. My own specimens from Kangra and fresh birds examined in the Ceylon survey are quite indistinguishable.

P. 78. *Brachypternus benghalensis woodi* (Jagabhad).

This is of course merely the intermediate between *puncticollis* and *tehminae*. The existing races of *Brachypternus benghalensis* are already sufficiently difficult to separate and there is no value in giving names to their intermediates. I have already pointed out (*J.B.N.H.S.*, xxxvii p. 292) that the red fringing to the feathers found in a greater or less degree on the golden upper parts of many specimens has no racial significance beyond the fact that it apparently never occurs in the desert race *dilutus*.

P. 78. *Chrysocolaptes guttacristatus socialis* (Jagabhad).

In the British Museum material, I could see no difference between birds from South India and birds from Malaya. On the Rothschild material Mr. Koelz claims a difference in colour. An independent examination of fresh material seems necessary.

P. 78. *Xantholæma hæmacephala confusa* (Londa).

The differences alleged appear to be due to wear. I have examined a good series of this species from the whole of the west of Peninsular India and, allowing for differences due to wear and individual variation, could find no difference between them and other Indian birds.

P. 79. *Tockus birostris pergriseus* (Lahore).

This race is based on a single specimen on characters which my own Punjab series shows to be merely a question of individual variation.

P. 79. *Harpactes fasciatus legerli* (forests at the fort of Mahendra Giri, Orissa).

This race is based on a single specimen so it is difficult to understand how Mr. Koelz can say 'the wing may average longer.' I have seen no specimens from this area and can give no opinion therefore on the validity of the new race.

P. 80. *Caprimulgus asiaticus gurgaoni* (Huttin, Gurgaon).

There are other Gurgaon specimens in the British Museum and this race may be recognisable. Yet it would be well to bear in mind what I wrote in the Eastern Ghats Survey (*J.B.N.H.S.*, xxxviii, p. 38). 'I have not been able to understand the division of this Nightjar into races satisfactorily. There are at any rate three colour phases, pale sandy, brown and grey and there appear to be some correlation of these phases with locality, the pale sandy-birds coming from the north-west, the grey birds from the Deccan and the

brown birds from other localities. The phases, however, so grade into each other and there seem to be so many exceptions to their connection with special localities that I hesitate to consider these colour phases as definitely subspecific.'

P. 80. *Tyto alba crypta* (Londa).

I have examined a large number of Barn Owls in the British Museum and elsewhere from the Punjab to Travancore (including specimens from Bombay and from Belgaum close to Londa) and all are evidently one, somewhat variable form *T. alba stertens* of which this new name appears to be a synonym.

P. 80. *Otus bakkamœna stewarti* (Bajnath, Kangra).

Mr. Koelz has here evidently been deceived by individual variation. I have a small series of these Scops owls from Kangra and they are variable both in depth of colouration and in the amount of darker marking. The name will be a synonym of *plumipes*.

P. 80. *Agolius funerea juniperi* (Kylang, Lahul).

This species is a most interesting addition to the Indian Empire list and I have no material on which to discuss the validity of the new race.

P. 81. *Streptopelia orientalis sylvicola* (Castle Rock).

It is difficult to discuss the colouration of these doves from written descriptions, but Mr. Koelz has not stated how this series, evidently breeding in March at Castle Rock, differs from the breeding bird of the Peninsula whose exact range is uncertain, but which clearly breeds both in the Sambalpore area and in Mysore. If the same, as would seem to be the case, it already has a name *Turtur erythrocephalus* Bonaparte, Consp. Gen. av. vol ii. p. 60 after April 15, 1855 (type locality *errore* Cape of Good Hope) of which the type is in the British Museum.

P. 82. *Burhinus œdicnemus mayri* (Londa).

I have not seen any specimen of a Thick-knee from this area so cannot comment positively on this new race. All birds examined, however, from Cutch, Gujrat, Khandesh, Central and South India and Ceylon belong to the one from *B. œ. indicus* so one would hardly have expected a local race of limited distribution in this area.

P. 82. *Lobivanelus indicus lankæ* (Galgamuwa, Ceylon).

There seems to be very little point in separating a Ceylon race of this species. The position is as follows. This species grades in size and colour from Ceylon to N.-W. India. If birds from these two extremes are compared they are fairly distinct, Ceylon birds being deeper in colour above with the gloss, especially the purple gloss, more pronounced. They are also slightly smaller, but not as small as Mr. Koelz's Series (3 ♂ Wing 201-209 mm.) suggests. 4 males in the British Museum have wings of 213-223 mm. and 4 males obtained by the Ceylon Survey have wings of 211-220 mm. Five males from the Punjab in my collection have wings of 211-234 mm. The type-locality Goa lies in the middle of this intergrading but closer to Ceylon than to the north-west. There is so little difference between the two extremes and there is so much individual variation that I wondered at one time whether it was even worth recognising the two races *indicus* and *aigneri*. To divide the intergradation into three races seems quite valueless.

H. WHISTLER.

CALDEC HOUSE,

BATTLE SUSSEX, ENGLAND,

7-10-1941

THE EARLY STAGES OF INDIAN LEPIDOPTERA.

BY

D. G. SEVASTOPULO, F.R.E.S.

PART IX.

(Continued from Vol. xlii, No. 4 (1941), p. 756.)

RHOPALOCERA.

SATYRIDAE.

Meianitis leda L., *ismene* Cr.

Moore, *Lep. Ceyl.*, i, 14, pl. 10, fig. 2b. 1880-81.

Bingham, *Fauna Brit. Ind.*, Butterflies, i, 159. 1905.

Ovum spherical, the base flattened. Pale silvery green, without sculpturing. Laid in twos or threes on the underside of a blade of grass. Laid 25-ix-41. Hatched 29-ix-41.

1st instar—Head large, dark brown, the mouth parts paler and with a pale knob on either side of the vertex. Body white when first hatched, turning green after feeding. Anal plate produced into two short processes. Both head and body clothed sparsely with comparatively long black hair. Moulded 1-x-41.

2nd instar—Head black, hairy, square, with comparatively long black horns in place of the pale knobs of the previous instar. Body blue-green, at first unmarked but later a double dotted white subdorsal line develops. Anal processes comparatively longer. The body clothed with short colourless hairs, the anal processes with black. Moulded 3-x-41.

3rd instar—Similar. The hairs on the anal processes colourless. A second form has the head green, the horns black, and a black stripe edged behind with white from the base of the horns to the side of the jaws. Moulded 5-x-41.

4th instar—Head square, black and hairy, an elongate white spot laterally just outside the jaws, horns black. Some examples have three green spots frontally, which may be joined together into a roughly triangular mark. A second form has the head green, the horns black and with a black stripe edged behind with white from the base of the horns to outside the jaws. A third form is similar but the black stripe is broader and there is a black stripe across the vertex connecting the base of the horns. Body rather yellower green than previously, shagreened. A dark blue-green dorsal stripe edged with a line of minute yellow dots, a double subdorsal yellow dotted line and a pale subspiracular stripe. Moulded 8-x-41.

5th instar—Head similar to previous instar but the horns dark purplish with black hairs. The black stripe of the second form often with a tooth onto the face about two-thirds down its length, in which case the stripe is broader. Mouth parts black edged above

with white. Body similar to the previous instar but of a lovely bright grass green, rather similar to the colour of young paddy. Pupated 15-x-41.

Pupa suspended by the cremaster from a pad of white silk. Shape head truncate, thorax slightly humped, wing cases rounded. Colour jade green, rather translucent, a diffused darker abdominal dorsal stripe and an indistinct yellowish spiracular line. Veins of the wing cases dark. A male emerged 21-x-41.

Food-plant—Grasses.

The larvae keep together up to the 3rd instar, after which they scatter.

Described from larvae bred from ova deposited by a Calcutta caught female.

Moore, in *Lep. Ceyl.*, gives the following description:— 'Larva elongated, thickened in middle, pubescent, head large, surmounted by two short pubescent red processes, last segment also with two processes; pale green with longitudinal rows of whitish dots; dorsal and lateral line darker green; head bluish, striped with white and black. Pupa green, cylindrical, head and thorax obliquely flattened. Feeds on *Gramineae*.' The figure is untrue to life in both shape and colour. Bingham, without giving references, writes as follows:— 'Larva long, slender, somewhat fusiform, rough; terminal segment armed with two divergent setose fleshy processes (Moore). Colour grass-green with a yellow lateral line and many rows of small white spots, with the horn and continuing cheek-stripe red, and three black spots on the face, but sometimes the head and horns are dark brown with three white spots on the face (Aitken). Pupa, thick, smooth, abdomen dorsally convex; head case terminating in an obtuse point; colour pale watery green without markings (Moore).'

GRYPOCERA.

HETEROPTERINAE.

Matapia Moore.

Young larva—Head black, rather large and heart-shaped. Body bright crimson, tinged with green. A transverse black line on the posterior edge of the 1st somite.

Full grown larva—Head heart-shaped, amber yellow with the mandibles black and the eyes blackish. Body with the 1st somite only slightly constricted and the anal flap broad but not much flattened. Colour pale silvery green at the beginning of the instar, the green gradually fading and the larva becoming covered with a dense white powder as it ages, the secondary segmental folds tinged with yellow. A transverse blackish line on the posterior portion of the 1st somite. Spiracles black, that on the 11th somite very much larger than the others. A pair of dark orange kidney-shaped organs under the skin of the dorsum on the 9th somite. A few short whitish hairs, most abundant on the edge of the anal flap. Legs very pale fawn. Prolegs and venter whitish green. Lives in a spirally twisted leaf.

The transition from the coloration of the young larva to that of the adult is gradual, the head becoming paler in colour with each ecdysis and the crimson gradually fading.

Pupa in a cell made from a spirally twisted leaf and lined with white silk. Moth-like in shape, the divisions between head, thorax and abdomen fairly well marked. Somites rather deeply cut. Apex of abdomen flattened and triangular. Colour very pale whitish green, covered sparingly with a white waxy powder. The pupal skin is very thin and collapses completely after emergence. The pupa wriggles very violently in its cell when touched and makes a distinct buzzing sound.

Food-plant—Bamboos.

Described from a full fed larva found in Calcutta 14-ix-41, pupated 20-x-41, and a female emerged 28-ix-41.

PAMPHILINAE.

Astycus pythias Mab., *bambusae* Moore.

Head pale fawn with a dark brown central stripe from vertex to apex of the clypeus, where it divides and follows the clypeus' outer edge. Usual shape of the family with the 1st somite constricted and the anal flap broad and flat. Colour yellowish green, but the skin is transparent and the colour appears a dark green due to the contents of the intestines. The skin is so transparent that the larger trachea, silk glands, etc. are all clearly visible. Traces of a pale subspiracular line. Spiracles pale yellow. Legs, prolegs and venter paler green. A few short whitish hairs, particularly noticeable on each side of the anal flap. When completely full fed two small bright yellow kidney-shaped organs appear under the skin of the dorsum of the 9th somite. Lives in a cell formed from a turned-over leaf.

Pupa in a cell formed from a turned-over leaf; a bite is made more or less at right angles to the edge of the leaf and the flap formed is turned over and secured with silk. The cell is lined with white silk and covered with a white waxy powder, which also covers the pupa. Pupa moth-like in shape, pale yellowish chestnut in colour, the head, thorax and wing cases tinged with purplish. Cremaster broad and flat, a short stout spine on each side, the central portion with hooked, almost colourless, hairs.

Food-plant—Bamboos.

Described from a full fed larva found in Calcutta 8-ix-41, pupated 11-ix-41, and a male emerged 20-ix-41.

Baoris zelleri Led., *cinnara* Wall.

Moore, *Lep. Ceyl.*, i, 167, pl. 70, fig. 3b. 1880-81.

Head heart-shaped, pale olive green, a broad white stripe on either side edged behind by a narrower dark brown stripe. Ground colour of body bluish green, the secondary segmental folds rather more yellow. A darker dorsal stripe edged on each side with whitish and a whitish subdorsal line. Spiracles white. Legs, prolegs and venter bluish green. Shape with the 1st somite constricted, the anal flap broad and flat and fringed with a few short

whitish hairs. In the very early instars the head is black, developing a broad white stripe on the side in the penultimate instar. In some examples the black and white striped head appears in the final instar and the usual colour is not attained.

Lives in a folded blade of grass and suffers very badly from the attacks of ichneumons, out of six larvae found in the penultimate instar only one reached the final and that failed to pupate.

Pupa grass green, rather translucent. A double white dorsal and a white subdorsal line on the abdominal somites. Head produced into a stout spike. In a slightly folded blade of grass, secured by a girdle of white silk and the cremaster attached to the silk lining of the grass.

Food-plant—Grasses.

Described from a full fed larva found in Calcutta 13-x-41, pupated 15-x-41, and a male emerged 22-x-41.

Moore gives the following description under the name *Parnara cingala*:—Larva very pale olivaceous-blue, with a darker dorsal and a paler lateral longitudinal line; head yellowish. Feeds on Graminaceae. Pupa pale olive-green.'

HETEROCERA.

SATURNIIDAE.

Dictyoploca simla Westw.

Head green, with short bristly green hairs. Body pale silvery green, with a raised subspiracular yellow line which is flecked with orange below each spiracle. Dorsal area clothed with medium length erect blue-green hairs, lateral area and venter with short bristly yellow-green hair. A subdorsal and lateral series of very small green tubercles tufted with short urticating bristles. Spiracles blue and broadly ringed with blue. Legs orange pink. Prolegs green, the feet pinkish with a basal black ring. Anal plate and claspers green minutely flecked with black.

Cocoon net-like, of golden brown silk, the threads and mesh coarse. Pupa pale pinkish brown, the wing cases slightly green tinged, the intersegmental areas darker brown. Cuticle very hard and minutely wrinkled.

Food-plant—*Lagerstroemia indica* Linn. and a number of unidentified shrubs.

Described from a full fed larva found in Shillong 8-v-41, pupated 16-v-41, and a male emerged in Calcutta 20-xi-41. In Shillong, probably, emergence would not have taken place until March or April.

SPHINGIDAE.

Herse convolvuli L., *convolvuli*.

Moore, *Lep. Ceyl.*, ii, 5, pl. 75, figs. 1, 1 b-e. 1882-83.

Hamps., *Fauna Brit. Ind.*, Moths, i, 103. 1892.

Seitz Seitz, *Indo-Austr. Bombyces*, x, 527.

Bell & Scott, *Fauna Brit. Ind.*, Moths, v, 63, pl. ix, figs. 1-7.
1937.

Ovum disproportionately small, of the usual Sphingid shape. Colour bright jade green. Unsculptured. Laid 4-x-41. Hatched 7-x-41.

1st instar—Head round, yellow green. Body yellow green when hatched becoming darker and bluer after feeding, rather long and thin. Horn straight and black, the tip bifid. Moulded 10-x-41.

2nd instar—Similar. Under a lens the skin of the dorsum is shagreened and there is a bluish tinged dorsal stripe. Moulded 12-x-41. A wild caught larva was similar.

3rd instar—Similar. A lateral series of black spots, usually obsolete on 2nd and 3rd somites. Legs purple. Prolegs green, in a few larvae they were blackish. Horn upright, black, in a few larvae with a whitish band about one-third down from the apex, in these the underside of the horn is also whitish towards the base. Later in the instar a series of darker oblique stripes edged behind with whitish, and with a black speck in the centre of each, appears, these stripes extending from the dorsum to the lateral area. Moulded 15-x-41. The wild caught larva mentioned above did not develop the lateral oblique stripes towards the end of the instar.

4th instar—Head green with white granules and with a blackish lateral stripe. Body green with white granules. An interrupted purplish black subdorsal stripe composed of slightly oblique streaks. A lateral series of oblique pale stripes edged above with purplish black. Spiracles orange ringed with black. Legs purplish, the base black. Horn with the base orange, the rest black, in some examples with a whitish band about a third from the apex. Prolegs black. The amount of blackish purple marking varies considerably, some larvae having the subdorsal stripe continuous and broad, in others it being broken and narrow. The lateral stripes also may extend the whole length of the pale stripes or be reduced to a short streak in the middle. Venter with a blackish median line. Moulded 17-x-41. The wild caught larva mentioned above had the head green with white granules and a white lateral stripe. The body green with white granules, a series of oblique slightly darker green stripes meeting on the dorsum and edged below on the lateral area with whitish. Spiracles orange ringed with black. Legs purplish. Prolegs green. Horn whitish green with white granules, the extreme tip black and a black stripe along the upper surface from base to about a third from the apex.

Final instar—Head buff with an inverted black Y-shaped mark, a broad black subdorsal stripe and a second broader one behind it but not reaching the vertex of the head nor the base of the antenna. Ground colour of body deep chocolate brown speckled with paler, in some examples the ground colour is tinged with tawny. A pale buff subdorsal stripe on the thoracic somites, usually continued on the abdominal by a spot on the anterior portion of each somite, this spot sometimes becoming a streak. Some examples with traces of a buff dorsal stripe with a median line of the ground colour. A lateral series of oblique dark stripes, obscurely edged behind with paler, these stripes almost invisible in the darkest forms. A broad whitish subspiracular stripe crossed by an occasional dark brown

line. Spiracles black and set in circular black patches. Legs black. Prolegs and venter smoky brown. Anal claspers almost black externally. Horn black, downcurved. Anal flap outlined by an orange-buff stripe. Pupated 23-x-41. The wild caught larva was similar to the above in the last instar.

Pupa subterranean in an earthen cell. Colour chestnut brown, the thorax and wing cases paler. A dorsal stripe and the inter-segmental areas of the abdomen darker. Proboscis sheath free, in a rather flattened curve to about the end of the first leg sheath and then back again along the body, the end slightly bulbous. Spiracles and cremaster almost black. A female emerged 3-xi-41.

Food-plant—*Ipomaea palmata* Forsk. and *I. aquatica* Forsk. Bell and Scott give the following list:—*Phaseolus* spp., *Dolichos Lablab* Linn., *Arachis hypogaea* Linn., *Helianthus* spp., *Ipomaea* spp. and *Convolvulus* spp.

Described from larvae bred from ova obtained from a Calcutta caught female.

Moore's descriptions are somewhat vague and his figures anything but lifelike, the pupa in particular being incorrect both in shape and colour. Hampson ignores the existence of the brown form completely and mentions that 'the European form has a black spot above each lateral stripe, the absence of which is the only character relied on for separating *orientalis*'. The female parent of my brood was of f. *orientalis* and most of the imagines bred belonged to this form.

NOCTUIDAE.

Earias cupreoviridis Wlk. (*chromataria* Wlk.)

Larva mottled dark and pale brown, rather swollen anteriorly and armed with rows of short fleshy spines. It unfortunately pupated before it was possible to describe it in detail.

Cocoon canoe-shaped, of thick, dark brown, papery silk. As is usual in the family, the imago escapes through a slit in the front of the cocoon.

Described from a full fed larva found in Calcutta, spun 3-x-41, and a male emerged 12-x-41.

Mocis (Remigia) frugalis F.

Moore, *Lep. Ceyl.*, iii, 190, pl. 172, fig. 4a. 1884-87.

Hamps., *Fauna Brit. Ind.*, Moths, ii, 527. 1894.

Hamps., *Cat Lep. Phal.*, xiii, 89. 1913.

Head dark olive brown, the clypeus filled in with whitish and with a white stripe from apex to vertex with a fine central brown line. The brown part of the head with fine white lines, one rather broader one arising from the external edge of the subdorsal body stripe. Ground colour of body yellow, in some examples almost orange, in others tinged with green. A double orange brown dorsal line. A subdorsal stripe composed of three olive brown lines. An olive brown lateral line with two orange brown lines between it and the subdorsal stripe. An orange brown subspiracular line. The lowest line of the subdorsal stripe is sometimes much darker on the anterior two-thirds of the 7th somite. The intersegmental

area between the 4th-5th and 5th-6th somites velvety black but only visible when the body is bent. 11th and 12th somites with a subdorsal black dot. Venter similar in ground colour but duller, a dark median stripe and three olive brown lines close together laterally. Legs pale brown. Prolegs pale olive brown, the first two pairs obsolete. Spiracles blackish.

The larvae vary very considerably in depth and brightness of colour. One example had the subdorsal stripe very dark, the lines composing it and also the lateral line blackish brown. Another had a white line on either side of the double orange brown dorsal line.

Pupa in a small cocoon of thin white silk covered with blades of grass. Pupa purplish brown and covered with a dense coating of white bloom. Apex of abdomen slightly conical and wrinkled, surrounded dorsally by eight blunt teeth and with six hooked spines at the extreme end.

Food-plant—Grasses.

Described from a full fed larva found in Calcutta 30-ix-41, spun 2-x-41, and a female emerged 11-x-41.

Moore's description is 'Larva semi-looped; with twelve legs; pale yellowish-ochreous, with slender longitudinal darker ochreous lines, an intervening sublateral row of dark olivaceous spots, and two subdorsal lines; fifth and sixth segment posteriorly edged with a dorsal black streak. Pupa ochreous-red. Feeds on *Zinziberaceae*.' Hampson's description in the *Fauna* is based on this but in the *Catalogue* he quotes the following description by Semper (*Reise Phil. Schmeltz*, ii, p. 564, plate T, fig. 2):—'Ochreous with numerous fine waved red-brown lines, the subdorsal, lateral and sublateral stripes with black-brown lines; maculate black dorsal bands between 5th and 6th and 7th and 8th somites; a yellow stripe below the stigmata and ventral stripe; first two pairs of claspers absent. Food-plant, *Zinziberaceae*.'

Chalciope hyppasia Cr.

Sevastopulo, *Journ. Bomb. Nat. Hist. Soc.*, xlii, 289. 1941.

The larva is extremely variable. In addition to the form previously described, a brood bred from ova in November 1941 contained the following.

One form very similar to that originally described but with the subdorsal and lateral areas irrorated with blackish. Another form had the 4th to 6th somites so densely suffused with blackish that the usual markings were obliterated, the subdorsal stripe being indicated by a series of white specks. The ground colour of this form may be yellowish, greyish or tawny, the lateral and subdorsal areas suffused to a greater or lesser extent with blackish. The head in the dark forms rather darker than in the form originally described.

GEOMETRIDAE.

Hyperythra lutea Cr.

Ovum barrel-shaped, dark slate grey and with about fifteen prominent longitudinal ribs, which do not extend to the ends of the ovum.

Newly hatched larva very long and slender. Bright chestnut brown in colour.

The larvae were offered Peepul, *Bauhinia* sp., *Lagerstroemia indica* Linn., *Rhynchosia minima* DC., *Polyalthea longifolia* Wall., *Ipomaea palmata* Forsk. and a cultivated *Euphorbia*, but refused to feed.

Ova laid by a Calcutta caught female 24-x-41, and hatched 28-x-41.

PYRALIDAE.

Crocidophora ptyophora Hamps.

Head chestnut brown. 1st, 2nd and anal somite clear yellow. 3rd to 12th somites creamy yellow, a dorsal line and the intersegmental areas with the skin transparent and the dark green colour of the contents of the intestines shewing through. Legs pale chestnut. Prolegs creamy yellow. Venter coloured as dorsum. A few pale hairs. Before pupation the green colour disappears and the larva is a creamy yellow with the formerly green parts a pale clear amber.

Lives in a cigar-shaped roll of bamboo leaves, rolled the one over the other and secured by a few coarse strands of white silk.

Pupa in a slight cocoon of white silk and frass formed at the lower end of the larval case, the head pointing upwards. Colour bright chestnut, the ventral surface and wing cases considerably paler. The first four abdominal somites with a raised dark blister-like ridge dorsally.

Food-plant—Bamboos.

Described from a full fed larva found in Calcutta 8-ix-41, spun 11-ix-41, and a female emerged 19-ix-41.

Glyphodes bivitalis Guen.

Moore, *Lep. Ceyl.*, iii, 322, pl. 180, fig. 2a. 1884-87.

Hamps., *Fauna Brit. Ind.*, Moths, iv, 355. 1896.

Head honey colour. Body yellow green with the contents of the intestine shewing as a dark green central chord. 1st somite with a black dorsal plate. 2nd and 3rd somites with a black subdorsal spot with a conjoined white speck above. 11th somite with a transverse series of four black specks. Legs and prolegs almost colourless. The skin, except for the spots, is unpigmented the yellow green colour being due to the blood and fat. Before pupation the ground colour becomes a clear pinkish yellow. Lives in a folded leaf.

Pupa in a web of white silk in a folded leaf. Colour yellowish brown, the dorsum, particularly the intersegmental areas, rather darker. Leg sheaths, etc. very long and reaching almost to the end of the abdomen. Proboscis sheath projecting slightly frontally.

Food-plant—Peepul.

Described from a full fed larva found in Calcutta 3-xi-41, pupated 8-xi-41, and a male emerged 16-xi-41.

Moore's description is 'Larva rather stout, attenuated at the ends; olive brown, palest beneath; head reddish, and with a black lateral streak; a dorsal, subdorsal and lateral row of white dots, the latter with a few fine short radiating white hairs; some black dots on anterior and posterior segments. Pupa pale olivaceous-red; with an acute anal point and lengthened pedal sheath. Feeds on *Ficus oppositifolia*.' His figure shews a larva with a reddish brown dorsal and yellowish ventral area, the two divided by a grey-blue lateral stripe. Hampson's description is based on that of Moore.

(To be continued).

ON THE BANKS OF THE NARBADA.

BY

LIEUT.-COL. R. W. Burton, I.A. (*Retd.*)

PART II.

(With four black and white plates).

(Continued from Vol. xlii, No. 4 (1941), page 765).

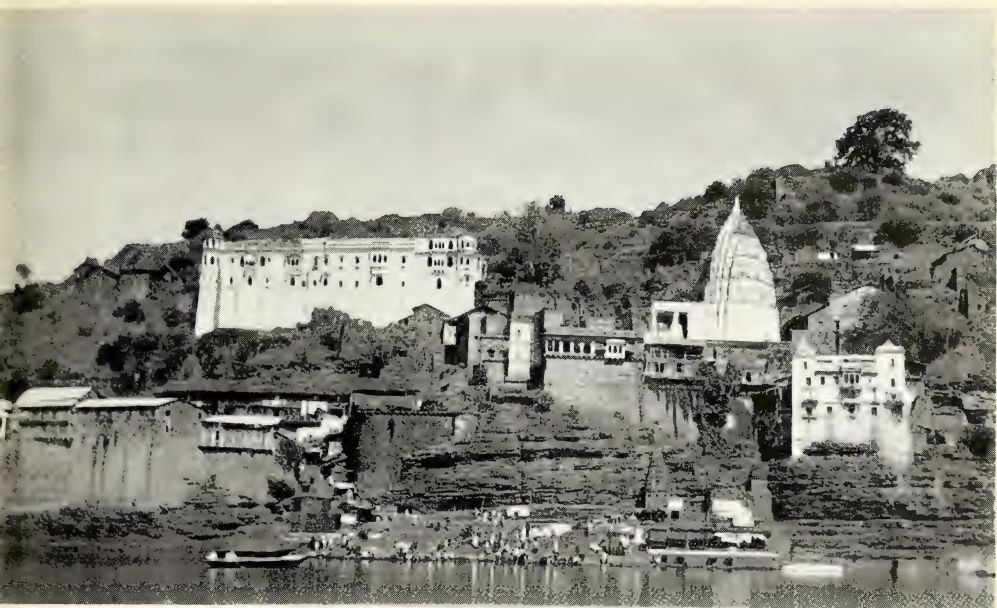
Now that there are some forty thousand miles of working railways in India it is difficult to realize those days prior to 1851 when the first section of the G. I. P. Railway was commenced from Bombay. Then the Narbada river was accessible only after weeks of travel, much of it through wild and difficult country.

The portion of the river where we are is about forty miles upstream from Dhariaghat, and some fifteen miles north of the line which runs more or less parallel to the river between Khandwa and Hoshangabad. There is no made road, so the car has a rough passage over tracks seldom traversed, even by bullock carts.

It is on the 25th December we reach the river to pitch camp in the open, in the vicinity of shady trees beneath which the tents will be placed when the weather gets warmer. Some young buffaloes are procured at an average price of eight rupees, and two goats at about the same rate. There are few villages, so beating after a 'kill' is not feasible and slaying of carnivora has to be from hide or machan. After a careful survey up and down stream a large tamarind tree by the side of a path some fifty yards from the river bank a mile and a half east of camp is fixed upon for a full length machan, the deciding factor for the exact location of the buffalo being the possibility of noiselessly stalking the place from the shelter of a sandbank and some bushes at earliest dawn, when the tiger should be on the 'kill'.

Less than a mile down stream a shady tree overhanging a steep path to the water is chosen for a chair; the place for the poor buffalo to await his blood-thirsty slaughterer being beside a drift-wood tree trunk already half imbedded in the sand, a protruding branch, suitably trimmed, affording an excellent hold for the unbreakable wire rope with which the animal is to be tethered. Tracks have shown that tigers are in the habit of crossing the river, from island to island from the thick forests of the Indore side, to wander about the river bed and along the higher banks, on the look-out for game and domestic animals.

There is much acquired experience in all our arrangements. The machans must be well screened all round, also from above and below, this having to be done before any bait is tethered. Nothing is left to chance. There is a rest for the rifle and a small peephole, separate from the aperture from which the shot is taken by leaning forward, so that the kill can be observed without movement on the part of the watcher. Some nails are fixed into the tree trunk and boughs on which to hang water-bottle and other sundries. Each



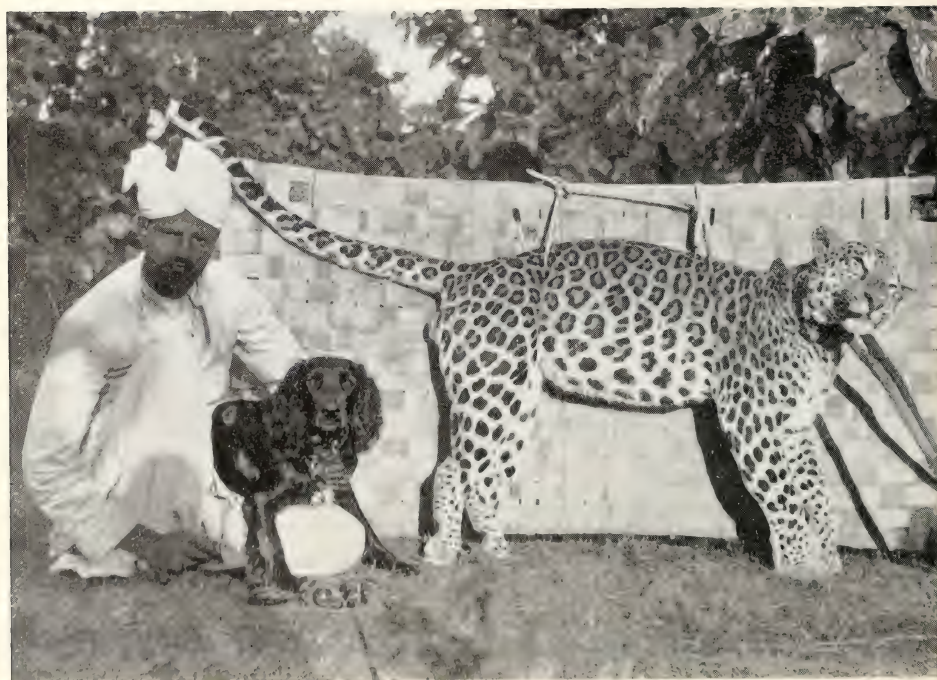
The Temple of Omkar on the Island of Mandhata.



A Narbada crossing : the Fort Ferry.



A Narbada Tiger.



Little Ben's fifth Panther.

day green branches are intertwined within the screen so that soon the machan viewed from the outside appears to be a mere bundle of dry leaves. To the chair a comfortable foot-rail is essential, and a small pillow has to be tied where the head will comfortably rest; for the vigil may be long or it may be short: we have to await the pleasure of our guest to his dinner, and at this season of the year we should be in position by three o'clock in the afternoon.

When all is ready at both the selected places men are engaged—two for each buffalo as they won't go alone—to tie up the baits each evening and visit them in the morning about an hour after sunrise. The animals require one's personal attention as to plenty of dry grass for night bedding, and proper feeding and watering during the day. Grass hereabouts is difficult to get, so a cartload is obtained from a distant village. We have two spare animals in order to give each 'bait' an alternate 'night in bed', and a couple of goats.

With mind at rest regarding all arrangements there are interesting walks abroad to learn one's surroundings. From the camp we see a ferry plying backwards and forwards across the river. The large flat-bottomed barge is run by a contractor who secures the necessary labour by subsidizing the villages on either bank, the people arranging among themselves a 'roster of duty'. The ferry fees are moderate enough. Two annas for a loaded cart and an extra anna if the bullocks are carried. An anna being a consideration most of them have to wade and swim, so there is much shouting and throwing of stones to force the animals across. Fare for a human passenger is one pie—rather more than a farthing!

It was by means of a number of barges of this kind collected from up and down the river that a passage was effected in 1817 by British Forces at the Hindia Ghat, which is twelve miles upstream. The army marched north into Rajputana, to fight the campaign against Holkar and the Pindaris which culminated in the battle of Mehidpur (21 Dec. 1817), the final defeat of the Mahratta confederacy, and the suppression of the Pindari marauders.

The village from near which the ferry plies is a small one of ten or twelve houses; the inhabitants Rajputs and Dhimars, with one Korku family providing the Headman appointed by Government. He is also the local shikari, but not of much use, being old and having fever every other day. This we treat him for and learn that there are two tigers on this side and others in the Indore forests along the further bank. A blue-bull being seen in the jungle the Korku is asked his taste in meat and replies that he could not stomach such flesh as that! and when an antelope is brought into camp and the tape run over its horns by a Christian and therefore 'unclean' hand he, in common with the low caste Dhimars, would have no truck with the meat. Such is the Hinduising influence of residence along the banks of this sacred river; for in the Satpura Hills not far distant, the principal habitat of this jungle tribe, the Korkus eat tiger, panther, bear, and anything else that may be shot, even if the Sahib has had the principal hand in the skinning. It is the same in all the riparian villages of the valley in which some of these aboriginal Korku people have even taken to adding the Rajput affix 'singh' to their own lowly

patronimics; and 'Kuer' to that of their women. The cult of social climbing is common to all mankind.

The camp larder is empty and we have to find the wherewithal to fill it, so the mornings find us early abroad with a view to rounding up peafowl, junglecock, partridge, pigeon, with shot gun and .22 rifle. We have to work hard for small results.

In this way several days pass, and then the down river buffalo is killed by a male tiger whose pugs show large in the sand. We see by the tracks that he was hunting along the reeds and bushes of the river bed; that he saw the buffalo and made rapidly towards it; that he swam across a small lagoon and then, quickly stealing under the bank beneath the dark shade of trees got within a few yards of his unsuspecting victim, the body of which is now covered with branches weighed down by stones. We have known a branch pulled aside by a prowling jackal expose a limb to the ubiquitous crow with the consequent arrival of hawks and vultures and the complete disintegration of the 'kill' and the loss of any chance at the tiger.

It was intended to be in position by three o'clock but we are late in leaving camp, so final screening operations are still being done when the coughing of the ever-watchful lungoors announce the tiger is on the move close by. The men hurriedly unscreeen the carcass and make off up the river bed. The suspicions of the tiger have been aroused. He has heard movement at the place; and instead of appearing in daylight as he would certainly have done, keeps away until 10-30 p.m.

The moon is well above the trees, and the kill, in the shadow early in the evening, is now in the light, almost as clear as daylight, of a moon at the full. The stillness of the jungle at this hour of a breathless night can almost be felt. One could hear a pin drop. So when there is a slight rustle on the bank but a few yards away it is known who has arrived on the scene. After several minutes—we well know his attitude of intent listening watchfulness—we hear his heavy approach as he sets aside all caution and comes striding down the sandy incline to pass within twelve feet—less than that—of the muzzle of the rifle so soon to rend the peaceful night. Lifting the carcass with a quick movement, as is almost invariably done on first arrival, he finds it still hard and fast so stands, again intently listening, at gaze over the river bed. A jungle king indeed.

The rifle is raised, sighted and lowered. There is plenty of time, and such preliminary sighting shots are a guard against undue haste. It is the first shot which is all important. The stillness and beauty of the night is torn by the tremendous explosion of seventy-five grains of cordite. The stricken beast lurches to one side, collapses, and slides to the foot of the slope, shot through the heart and instantly killed by the terrific impact of the soft nose and split bullet of five hundred grains weight. One moment standing in all his majestic strength and symmetry, the next his life extinguished, and his death even more merciful than that of the buffalo he slew a few hours before. He weighed 400 lbs.

A period of ten days elapses before the tigress puts in an appearance. For six successive mornings the tied-up buffalo is stalked at

earliest dawn in hopes of that shot which, in common with stalking sleeping tigers near jungle pools in the hot weather, is the acme of all tiger shooting. On the seventh day we were weary of the dark and difficult walking over the stones of the river bed to the sandy patch from which the stalk commences, so take a day off. That very morning the tigress is found to have killed! One should never let up, but persevere to the end.

She was an unwary beast, or very hungry. Having slain the buffalo at about daybreak, as could be known by the tracks along the sand, she appeared shortly after four o'clock with the slanting sun shining fitfully through the tree-tops on her striped hide.

Previously to this three jackals arrive, and as the right eye had been giving trouble for some days a 'sighting shot' is taken on one of them, using left eye and right shoulder. In very early days the useful accomplishment of shooting with a rifle from either shoulder had been acquired, but the machan having been arranged for a right shoulder shot this third method of aiming is found necessary on this occasion—and not for the first time. The tigress frequently looks in the direction of the path through the forest along which the men visited the kill, so there is little doubt that she was feeding in the early morning. A memorable opportunity missed for want of one more morning's perseverance.

The soft-nose-cum-split bullet does instant execution as usual. Such a bullet is best for all sideways shots, the soft nose in the other barrel being used for chest shots, or when the bullet has to rake forward. Two 'dongas' (dug-out canoes) are obtained, and the poor tigress is peacefully floated down the beautiful river along the banks of which she had hunted for so many years; for she was quite an old beast, may be twenty years or more, her teeth very yellow and blunt, the left lower canine broken, the eyes filmy with the appearance of approaching blindness. It was afterwards regretted they had not been preserved for examination by an ophthalmologist. She weighed 280 lbs.

It was expected that some time would elapse before other tigers took the places vacated by these two animals, and so it proved. Another year, however, finds us at the same place: and making similar arrangements we await the pleasure of the tiger and tigress, successors to their departed relatives, who are now in possession. We do not, alas! have the same fortune, as the tiger is disposed of by a village shikari over a pet bullock some miles away, and the tigress is the wildest met with for many a day. She killed the upstream buffalo very early one morning, the tracks showing that when first sighting the tethered animal she stuck out her claws, whisked round, and galloped off to the jungle fifty yards away; but eventually came from another direction and killed. It may be she would have returned that night to meet her fate but fortune was on her side. The night's vigil was unrewarded, the reason being that while she was awaited in the machan she was feeding off a calf, chance met in the forest. A second vigil was also fruitless, but interesting as a large mugger issued from the pool close by and had a good feed on the kill. The wire tethering rope was proof against his efforts to take the carcase to the river.

Tracks and jungle noises showed the wily tigress to be still

in the vicinity, so another boda was led to take the place of the other, now almost completely demolished. Owing to mistaken kindness a drink was given too soon after a feed on green grass so the severe colic which ensued prevented the buffalo going more than half way to the machan. It was left near a jamun tree which would afford sufficient roost for a chair, and where the tigress would be sure to find it if she hunted along the bank of the river.

Sure enough she did. It was found that after slaking her thirst early in the morning as known by the drops of water in the sand, she had sneaked along among the reeds in one place going belly to ground to pass under an arch of reeds, not eighteen inches high, then, rounding a small bush, she came right on to the boda! This was too much for her nerves for she stuck out her claws and raced off to the forest close by. The buffalo being ill—it died later—must have been lying very quiet: the tigress did not return. Had the buffalo not fallen ill she might have come along to the machan and killed it.

Twelve days later this same tigress came from up river, saw the boda, stopped, and went up the bank, had a backward look, went on to a place in deep shade and had another look, then passed on down river. All this being very plainly written by her tracks. Evidently a very cunning beast, and probably with some sharp experience to remind her of the danger attending a tethered bait! So we are tigerless on this trip.

The ferry is close to the northern end of an island on which is a fort dating from the time of the marauding Pindaris. It was built by Amir Khan, a noted Pindari Chief who wisely entered into a treaty with the British Government and so, in the settlement subsequent to the battle of Mahidpur, secured to himself and his heirs Jaghirs as price of his standing out of the war. Chitu, another Pindari Chief of the same period, although described as more sagacious than others of his kind, continued in arms and was hunted down like a wild beast all over the country until eventually he was killed by a tiger which devoured him in the jungles of Asirghur.

The Fort is constructed of boulders collected from the river bed, put together with mortar. It is protected under the Monuments Act enacted during the Viceroyalty of Lord Curzon. There are three tiers of battlements, many loopholes, but no gun embrasures. It is lozenge-shaped as is the island on which it is built. In places the walls are in course of disruption by the roots of banyan and pipal trees, those deadly enemies to all masonry in eastern countries. In the north-eastern corner are several former granaries, and two tombs said to date from the time of the construction of the fort (1795?); there is also a small Hindu temple of no architectural interest, and a Musjid, the white minarets of which can be seen from afar. Access to the river water was on the north side by means of a flight of steps leading to a well at the water's edge. Just here is a wide, deep pool fed by two rapids: a good place for gram baiting and an occasional five-pound mahseer by spinning bait or fly spoon; but it is much harried by the village fishermen. Two miles up stream there is more good water, but it is difficult and toilsome to fish this river by means of dug-out boats, and often have I longed for the Berthon Collapsible boat of former days



Omkarji : The Sacrificial Precipice.



A Narbada Fort of Pindari Days



for, apart from transport difficulties, the dug-out is unwieldy and noisy for river fishing of the kind one likes. A buffalo-hide and bamboo basket coracle of the pattern used in South India would be excellent, but would entail the importation of a man from those parts to work it. There is an American made rubber collapsible coracle which carries two people and is propelled by sculls. That would be a less troublesome boat. Indians soon pick up rowing, but not the coracle paddle, which is an expert business needing long practice and experience.

During these days of waiting tigers were actively killing on the Indore side, and the Chamars of the opposite village were early on the spot each morning. One evening about half past seven there was a great squealing of porkers from that direction accompanied by grunts of the attacking tigress, for such it proved to be. The noise lasted for twenty minutes, and a previous experience of the kind caused the remark that there must be cubs under instruction. In the morning the Chamars were early on the scene, and by the time I got there the carcasses of two pigs had been taken away. It seemed that the tigress had sprung amid the sounder and disabled two half-grown pigs by blows of her paws, as both the animals were slain within a few yards of one another. One carcase had been taken to the river bank and there placed beneath a jamun bush: the other into some long grass in a side nala. Tracks showed there were two cubs of three or four months: so instruction it was.

Panthers kept clear of tied up goats and bodas in an unusual fashion. None were killed, but one morning tracks of two panthers were noticed a few yards from a tethered goat. Perhaps the wind was favourable to the goat, and it was lying so still as to escape detection. That sometimes happens.

Our Irish Terrier of the Kerry Blue type, named 'Simba' because ten years earlier she was just a little lion cub in appearance, might have met a tragic end one evening when we were quietly strolling along a jungle path not far from camp. There were lungoors all unexcited in leafy tree so presumably no danger about; but, nearing the tree, beneath and around which was thick lantana, there, plainly to be seen from ground level, was a panther! Simba was at once chained, and our movement disturbing the crafty feline it was quickly detected by the ever watchful lungoors. Then there was no end of a scolding and swearing demonstration. Doubtless had we not appeared on the scene some one of the long-tailed party, descending unsuspecting to the ground, would have been seized for an evening meal. Simba was herself of yellowish colour and often sworn at by arboreal watchers as a possible enemy while other dogs of darker colour would be ignored. Dear Simba! One silky yellow ear cocked, the other flapping. She must be given a place of honour posed on a table at the Narbada camp.

Thinking of Simba turns thoughts to question of camouflage. The colour of one's clothes is important. A khaki coat hampers approach even to the forest doves. Most of us have recollections of a borrowed cultivator's blanket securing a shot at a black buck otherwise unapproachable in one's ordinary shooting kit. The simian tribe will scold and thus alarm all the jungle folk within hearing

when they spy the Sahib creeping about in a khaki coat. And that topee! there is nothing like it in nature so it must be concealed by leaves kept in place by a band round the crown.

One thing leads to another; and this train of thought reminds me that from my very early days in India my gun and rifle barrels have been painted a dull khaki-green, but not all a uniform colour—stripes and blotches!—much to the disgust of the gunmaker who disapproves of his work of art being thus disfigured. It was instructive when crouched among the reeds on a duck jheel to see the wild swerve of the birds from a companion sportsman concealed on the further edge, any slightest movement of his gun being a danger signal to the wildfowl. As with guns so with fishing rods; how many fish have not been scared away by the flashing signal of a varnished rod? Modern craftsmen and anglers have neglected to paint their rods green after the manner so carefully instructed by Izaak Walton in 1653 and the many subsequent editions of *The Complete Angler*.

It is in the cold weather of a later year that inclination and opportunity find us again in the Narbada Valley and once more setting out from Punasa. A preliminary is a walk of some eight miles to the west to scout around for information and tiger tracks, the result being old and new pugs of a large tiger north of Borphal village: there is also news of several panthers levying toll of calves from the gowala's encampment close by: so camp is pitched in that neighbourhood.

The last rain in this area was on the 19th October so the tiger is located all right. The dews are very heavy and the nights cold in this first week of November. In spite of the people being in a half starved condition owing to severe agricultural depression they will not reduce their demand of eight rupees for a small buffalo calf. 'Gandhi Maharaj is our God,' say they; perhaps that has something to do with it. A Muhammadan attached to the camp as a Forest Guard introduces himself by intimating that the last Sahib gave him free rations, thirty rupees, and a watch! He gets five rupees for rations and will live in hopes of the rest.

It is interesting to wander several miles through strange forest and view the Narbada, now in flood. Several sambur are seen, also tracks of a bear, and not far from camp remains of a nilgai calf are discovered in the fork of a small teak tree, placed there by a panther during the previous night. Passing the same place on our return the panther is found to have removed his meat, so quite likely he was not far off when we first saw his temporary larder.

Not far from the river the villager shows a place where is a perfect hot-weather retreat for a tiger; from this small amphitheatre is but one entry and exit so Tom Puss taking his kill into that fancied security would be as good as bagged. In level country such places are rare: when found make a note! A peafowl, a hare, a green pigeon are shot with the .22 rifle. The jungle is very leafy, grass and undergrowth thick in places not grazed down by cattle, and passing through it one gets soaked from the waist.

Next day the coming and going tracks of the tiger are seen on a path to the west, the return tracks clearly showing he was in a very bad temper about something, as he had torn up two teak

saplings with his teeth and violently raked the ground in several places. Perhaps he had failed in his stalk of some animal and did not like the idea of tummy rumblings for another day. A sambur with horns recently out of velvet and $39\frac{1}{2}$ inches long is shot much to the satisfaction of the villagers, the morrow being the day of the Diwali Festival. The village shikari assists in moving the beast for purposes of a camera picture and does not let on to his co-religionists that the Sahib's hands have pulled the animal about! There is questioning on the point when the cart brings the animal to camp but the shikari is a tactful man: what the eye does not see, etc.

On the night of the 9th November a calf was killed by a panther and about the same time the tiger passed by the tethered buffalo and refused to kill it. It is remarked to the men that he would probably return this night and take the bait; and so it proved. The machan is ready, and I should have been in it instead of avenging the death of the pretty white calf. That proves to be a fatal error. One should always follow one's intuitive knowledge in such matters. I *knew* the tiger would re-visit the bait but— —? no excuse. Little Ben, the black Cocker spaniel, is photographed with the third panther of his puppyhood.

The tiger's killing of the buffalo was particularly savage and there was blood all over the place, which is most unusual: he is clearly a bad tempered, savage beast. It sometimes happens that the tethering rope of flexible plaited wire is broken, and it is so on this occasion, the break taking place where soldering of the loop had been done. Joints should be plaited only, and not soldered. In most cases when that happens no harm is done as the tiger will return with less suspicion to a kill placed by himself; but there is not always a tree for machan, in which case it has to be dragged and arouse further suspicion. The kill is dragged forty yards so the prepared machan is of no use. Another is made, but the trees are small and the tiger must have detected it, as he gave no chance.

Two more all night vigils from another machan have the same negative result, and as the kill is very far gone we decide to strike camp and go to Makrar Ghat some miles up the river. The rough cart track is stony in some places, deep in tenacious mud in others. A yoke breaks and can fortunately be repaired by tools always carried on such trips as this. It takes an hour and a half to cut a suitable dry teak branch, shape it, and bore the holes for the iron neck pins. Were R. B. not able to do such jobs as this the camp would have had to be pitched on the spot, and a yoke obtained from some village, meaning a whole night of uncomfortable delay.

The early start which had been hoped for this short march of six miles did not come off; so it is past eleven when we follow along with the .22 in hand. The people are listless and lethargic from continual fever. On arrival at the camping site the shadows are fast lengthening and it is only possible to pitch half a tent for ourselves and one for the camp followers. Here, just above the high, steep bank of the river, it is much colder than at Borphal. The camp is in the forest and no habitations within several miles, though cattle graze up to a mile from where we are. The low hills are stony and covered with mixed forest and bamboos, while along the

banks of the nalas are large evergreen trees : here and there are open spaces covered with coarse grass.

During the night there are alarm calls of sambur, and in the nalas and along the sandy bank of the river are recent tracks of a tigress. It is interesting to notice how careful she is to keep in the shadows and take advantage of all cover and ground inequalities during her nightly perambulations. The river is several hundred yards wide in places and runs very strongly, for though much clearer the flood waters have not yet subsided to cold weather level.

It being obvious that the big tiger would one night certainly wander along the incoming cart track from the last camp, a machan is fixed in a tree where the path to camp leaves the main track. It is intended to pass each night in this machan, for one can slumber there as well as in camp, and hear all the jungle sounds. This is done for seven successive nights and then tracks of a tiger are found near the down river bait so the eighth night spent there. Fatal error ! That night the tiger passed below the machan where is no bait and no rifle. The only compensation was the lovely sight of a tigress wandering along the further bank in full light of the setting sun. People at the camp viewed her amid great excitement.

Now the time limit for this month's permit is not far off so we return to the neighbourhood of the cattle encampment. It is found that the tiger visited the putrid remains of his kill on the night after the last vigil for him, and that so far gone was it that it fell to pieces on the way to the place where he removed the horrible repast, little but the skeleton, and some hide, surviving the drag. Truly the tiger is a foul-feeding creature, and no wonder that wounds inflicted by him have been fatal to so many sportsmen. Now that medical science has produced M & B 720 there is considerable prospect of recovery from maulings by tiger and panther as compared with former days.

On the evening of the 28th November a male panther is killed, without incident, over a tethered buffalo calf. This is the animal which some days before had removed a calf from amid the tethered herd without stampeding the cattle or rousing the watching herdsman. A skilful marauder. He is a beast of marvellous grace, a splendid athlete in appearance. There are fast-healing wounds on head and neck conjectured to have been caused by a rush through the barbed wire untidily festooned round some of the adjacent fields. The milk-white mother of the pretty calf slain by the former panther is killed some miles from camp—the work of two tigers, says the reporting cowherd, as almost all the carcase has been consumed. Carnivora take considerable toll of cattle in all the jungle tracts and as game decreases so does the killing of cattle increase : and in parts of the country where cattle are carefully guarded and difficult to obtain, and the game is greatly reduced, the carnivora have taken to killing the people. The Sironcha jungles and the Kumaon Hills are instances.

Now time is up and we move camp to Dharighat for a few days fishing having failed to obtain a permit for the adjoining shooting block, though it is vacant and not asked for by any other sportsman. Shabby treatment to meet out to an old shikari for reasons

that can be conjectured, but not mentioned! The correspondence is treasured.

Thirteen days on the banks of the river produced half a dozen mahsir all between 5 and 9 lbs. The water was now clear but perhaps too cold, as sport was poor compared to the month of October on the former occasion. The diary records some marvellous sunsets: flaming skies of crimson and orange with a final glow as of an immense fiery furnace spreading over the great bowl of the heavens. There was light rain, as expected. The officials of the Dhar State on the further bank were kind and helpful in small matters of supplies for camp.

Four marches through a rocky and uninteresting terrain took us to a ferry thirty miles upstream where we crossed to the right bank by means of a large barge taking fully loaded carts, half a dozen or more at a trip. Camp was pitched near the village of Bagesar, the administrative centre of the Chandgarh Jaghir. The Mukhtear was helpful and politely hinted that the late Jaghirdar had not allowed people to kill peafowl and small deer. It was found that the wishes of the late Ruler as to this were strictly followed, and that the number and tameness of these animals and birds was markedly in contrast with Government Forest areas in the neighbourhood. It has been observed by the writer in several parts of India that the Landowners can, if they wish, exercise complete restraint in matter of preservation of specified species. What all the pains and penalties of the Government do not achieve is brought about by the 'hukam nahin hai' of the owner of the land. Similarly a religious embargo has great force.

In a few days a move was made to a pleasant camping ground in the vicinity of Chandgarh village six miles to the west. A small tigress was about but shied off tethered baits which she by-passed several times, neither did the local panther touch them, but he met his end through killing a calf in the centre of the hamlet of Jatam. The villagers did not protect the remains from vultures so there was not much left by the evening. However, the killer came to his grilled bones soon after dark and was slain by a chest shot. A fine panther; weight 125 lbs. His picture makes him somewhat resemble the beast on the fresco around the walls of the tea-room of the Tate Gallery in London. Little Ben's fifth panther; and he is getting more resigned to the joint photograph.

Bears are said to be feeding on fruit of wild plum trees a few miles to the east so a before-dawn visit is made to the place, with the result that a fine bear, seen at twenty feet and doubtless taken by Little Ben to be his grandfather, for he stares at him in astonishment, is handsomely missed over the top of the back. In the darkness the rifle had been carried by the local guide, so the 200 yards leaf was up. Such an elevation is never needed in jungle shooting and the leaf should always be fastened down. The arrangement had come unstuck, hence a bear with a whole skin, for which we are not sorry.

One day a place called Keralia was shown where one of the men some years previously had roused a tiger sleeping among bushes by side of the path where is moisture and cool lying in the hot weather. The man was centre of several hauling a boat up

stream, so no doubt the tiger thought he was being 'encircled'. Deep scars of bites on the buttocks indicated just the sudden get-away attack one would expect under such circumstances. There would be no particular malice in it. It is in a forest clearing near the village that one early morning we meet a charming little Korku maiden with 'nodings on'. She stands all unconscious, with bow and arrow set to shoot at some fancied mark, a most pleasing sight. Alas! that one morning the camera is not with us. However it is possible to arrange a formal picture which is not so bad.

On the 14th January camp was moved to the left bank as first stage of a seven days bullock cart march to a good shooting block in the more hospitable Forest Division of Hoshangabad.

Mention has been made of Omkarji. For one reason or other the hoped-for up-river trip from there to Dharighat was not made, but a visit to the locality, which is an important place of pilgrimage, afforded much of interest. Omkarji town is on the left bank of the Narbada, while the Temple of Omkar is on the island of Mandhata.

It is a striking view which meets the eye as one descends the wide flight of stone steps below the town, the slabs of which are secured by iron 'dogs'—a necessary precaution in view of the annual monsoon floods. A wide stream, deep blue with the reflection of the cloudless sky on its placid waters; above the tiers of steps on either shore tower many temples and other buildings; rugged, boldly stratified rocks, of a greenish hue, surmounted by yellowing forest of teak trees; crowds of people of all ages, sexes, and castes in gay apparel of many hues; boats of several sizes busily conveying packed loads of pilgrims to either bank; and small naked urchins in dug-out canoes eagerly diving for coins thrown to them and almost as much at home in the water as the fish and the crocodiles.

The river is full of fish. Mahsir up to twenty pounds can be gathered into splashing shoals by the throwing of a handful of parched grain. How one would like to 'fly fish' with monkey nut!

For three rupees a roomy boat is hired to take us up stream. We pass beneath the precipice at the eastern extremity of the island. It was from this rugged hill-top that voluntary human sacrifice used to be performed before the country came under British Administration after the year 1824. It was in that year the last sacrifice took place. It was witnessed by a British officer who vainly endeavoured to persuade the devotee, a lad of twenty, from hurling himself to destruction. A vivid description of all that took place is on record. The final act of the dread drama was the figure of the man standing on the brink of the precipice, in view of the hushed and expectant multitude, with arms outstretched while making the final invocations. Then he disappeared from view, to re-appear in a manful running leap silhouetted against the sky. Thus he fell half way, and then, striking a projecting rock, fell headlong, to be dashed to pieces amid the roar of voices on the rocks below.

As we pass up the placid stream we see men at work smearing a huge slab of rock with bright vermilion paint. They also put splashes of paint along the foot of the wall of the precipice, which they hand-mark with extended red fingers. An hour later, returning down the river, we see that the sacrifice has been completed; not

by the death of a sentient human being voluntarily hurling himself to destruction with the acclaim of fifty thousand throats, but by the cutting of the throat of a poor little kid whose life-blood smears the sacrificial rock—that very rock on which the devotees of a century ago were dashed to pieces—and whose entrails are being washed in the sacred stream to form a meal for some of the attendants: for though a formal sacrifice there is no need for waste!

Six miles below Mandhata is Mortakka, where the river is spanned by the road and rail bridge. It was fishing down stream in 1906 with a companion that the canvas boat sank, committing us to a lengthy swim before touching bottom. We lost the boat and all our rods and tackle. 'I have at any rate salvaged my boots,' says S, jubilantly. 'My boots,' say I, at once recognizing cork-lined surgical boot which had naturally come to the surface! It was not until later that we knew we had swum through the many crocodiles living just there to feed on the more or less burnt remains of devout Hindus committed to the sacred stream from the funeral pyres on the sandy foreshore. There was no danger, as the saurians are not accustomed to 'things' that swim.

This below-bridge reach of water used to be a favourite locality with anglers from the Mhow Cantonment. Excellent swims for gram baiting.

Now comes the final leave taking of 'Narbada Mai'. Perhaps we may never again enjoy halcyon days along its banks, but the memories are always with us.

A MONTH IN THE KAZINAG RANGE.

BY

LT.-COL. R. S. P. BATES, M.B.O.U.

(With eight black and white plates).

Thanks to the unsettled times in which we are now living, a month's leave was all I could obtain. The problem which arose therefore was which would be the most profitable area to work and the quickest to reach in the time available. Finally my wife and I fixed on the Kazinag range, as records of what birds those mountains contain are noticeably few and far between—not that we expected to find anything startling, but it appeared to afford a good opportunity of extending our knowledge of the distribution of Kashmir's birds.

The Kazinag is that range which starting at Baramullah closes the western end of the Vale of Kashmir, providing a stopper as it were to the monsoon between the Pir Panjal and the ranges enclosing the Kishenganga Valley. The north-eastern slopes are drained by numerous short and charming torrents going to swell the Pohru river which itself takes source in the extreme northern limit of the range. These slopes are clothed from almost valley level to between 7,000 and 8,000 feet in magnificent deodar forests which, except for a stretch along the Kishenganga Valley and in the Lolab, occur extensively nowhere else in Kashmir. Amongst the deodars there are of course other trees but this beautiful cedar predominates. At about 7,500 feet where they cease the forest assumes a more mixed character gradually becoming almost exclusively coniferous again as the 10,000 feet level is approached.

The birds of the deodar zone are mainly those of the same levels anywhere around the main Vale and its side valleys, but certain species are scarce—if not quite absent; it is hard to be sure on a month's tour—while others are more common than elsewhere; and one, the Slaty-headed Paroquet (*Psittacula himalayana himalayana*) has his headquarters exclusively in this zone, though parties raid out into the open valleys and spread further afield after the breeding season is ended and the maize has ripened.

We spent the night of June 3 at Baramullah, heavy rain having rendered the fair weather motor road to Handwara quite impassable.

Before leaving the next afternoon in a ramshackle bus whose front springs eventually proved unequal to the strain imposed upon them by that dreadful road, I noted that Slaty-headed Paroquets were not uncommon in the gardens though I only heard and saw single birds. That night we camped where the derelict bus had deposited us, in the vicinity of the bridge over the Pohru river two miles short of Handwara. Shortly before dusk I noticed two huge flights of Jackdaws which appeared to be heading for Sopor. Throughout the hours of daylight Daws were to be seen carrying food to holes in almost every walnut and chenar tree, so what



EASTERN JACKDAWS (*Corvus monedula sommeringii*)

Three pairs had young in holes in this one walnut tree.

birds went to make up these enormous evening flights I cannot imagine.

Our objective next day was Sanzipur 11 miles away, but I blush to call it a march for we annexed an ancient tonga, the driver affirming that he could put us three miles upon our way. Thanks to his dexterity in negotiating a much-damaged culvert, he eventually deposited us right at the gate of the Forest Rest House. The excuse for our ultra laziness was to be found in the presence of a Golden Cocker pup for whose legs exercise was still taboo. Needless to say he ran quite wild in the Sanzipur woods, covering many more miles in one hour on his fat little feet than we ever did in a day.

As we broke camp I noticed Paroquets were numerous, for small flocks appeared quite frequently zooming across the river with harsh squeals to the cover of a bagh near by. The bright yellow terminal third of the tail would be a perfect distinguishing mark were any needed, but the Slaty-headed Paroquet happens to be the only member of the Psittacidæ occurring within Kashmir proper.

Although Sanzipur is but 500 feet above main valley level, differences in its birdlife were quite apparent. Most of the Valley birds one would expect to see did occur, but some of these were already rare while a few quite common species were missing altogether. I saw no House-Crows, Starlings, Kingfishers or Paradise Flycatchers. Orioles were uncommon and Tickell's Thrushes very scarce. On all the side rivers running into the main valley from the north I have always found Sandpipers exceedingly numerous from the moment the slack waters are left behind right up to 10,000 feet and even higher. On these Kazinag torrents however, many of which are of fair size with plenty of low bushy cover along their stony margins and divided by many suitable islands, I saw one bird the whole trip, at Kiterdarji on June 27. On our return march to Baramullah as we dropped down to the stream at Panzal I did however hear the unmistakable querulous chittering of these birds being wafted up the hillside on the warm air of the lower valley.

But to go back to Sanzipur. I was struck by the appearance of species normally connected in one's mind with higher altitudes. Meadow Buntings (*Emberiza cia stracheyi*) occurred in small numbers in suitable areas, although this is the elevation where around the not so distant Wular Lake and on the rather arid slopes on the northern rim of the main vale, Stewart's Bunting (*Emberiza stewarti*) holds the field, the Meadow Bunting being quite absent. I had always considered the former as breeding up to about 6,000 feet only and then having its place taken by the Meadow Bunting. In fact I have often stressed that during the breeding months the habitats of these two species do not overlap. Yet at the end of June near Chak-i-Lal Singh, 5 miles from Baramullah where one crosses the last spur, I came upon both species in the same area, on grassy bush-dotted slopes not more than 200 to 300 feet above the valley. The presence of Meadow Buntings is often first given away by their very subdued mouse-like squeaks which they seem to keep up when feeding through long grass

and concealing cover, perhaps by way of apprising each other of their whereabouts or of giving warning.

There were a few pairs, very few, of Dark Grey Bushchats and I also on occasion heard the Pale Bush Warbler (*Horornis p. pallidus*) well within the forest though there was generally a parrotia dotted clearing of sorts not far off. This shy little bird is not uncommon within the State *rukh* at Achhibal so there was nothing very startling about its presence at this elevation; a point to note however is that in its higher range it seems definitely to avoid forest.

I disturbed a pair of Yellow-billed Magpies in the wood by the Rest House and came upon a Blue-headed Rock-Thrush there seated upon 4 fresh eggs. Cinnamon Sparrows started half a mile further up the valley at Vihom village. But what did surprise me was the scarcity of Hume's Lesser Whitethroats in country which seemed eminently suited to their habits. It is not many miles to those slopes around the Wular Lake where this species is so very common, but except for one pair seen at Sanzipur—I later found their nest in a rose bush—I never saw this bird in the Kazinag. Of course some birds were very numerous—Jackdaws, Mynas, House-Sparrows, and last but not least Slaty-headed Paroquets. It was evident however that we were at an intermediate elevation where species were many but individuals rather few.

On June 10 I had my first dealings with a Paroquet at its nest-hole, but that was a red-letter day for other reasons. Three times in the same locality, a deep shady nullah running up into the forest directly behind the F.R.H., we had come upon a Scully's Wood Owl (*Strix aluco biddulphi*), once on the pair of them. I could however find no nest although they seemed rather bold and, when accompanied by the Cocker, we were followed by one of them for about a hundred yards. I decided therefore to try a ruse which seldom pays. I screwed the stand on to the reflex, put in a film-pack, and fixed the strap round my neck. Walking quietly through their usual haunts I drew an absolute blank, but in spite of my awkward burden I fortunately did not give up hope. Crossing the little stream I tried a particularly gloomy patch of forest on the opposite side of the nullah. Quite suddenly I realised I was within twenty yards of an Owl roosting on a lower branch of a deodar and not eight feet from the ground. I approached quietly, not daring to look at the bird lest it take fright. When about 25 feet away I spread the tripod legs and started to focus; none too easy in so poor a light. However I stopped right down to make sure and exposed a couple of films giving one 5 and the other 15 seconds, during which the bird stared fixedly at the lens but with no undue signs of fear. Moving forward a few paces at a time I exposed a couple of films at each halt until I had used up eight and was hardly 12 feet from the bird. After the last exposure it seemed to have become so used to the procedure that it turned away its head, yawned deliberately, and closed its eyes. Emboldened by this extraordinary behaviour I moved still nearer, but when I looked down into the focussing screen the branch was bare; the owl had taken its departure as silently as a ghost.



SCULLY'S WOOD OWL (*Strix aluco biddulphi*)

Stalked as he was indulging in his daily siesta on the shady slope of a deep nullah.

At the bottom of the slope the Blue-headed Rock-Thrush was sitting on her eggs. As usual she allowed me to stand right over her, merely putting on that strained look so typical of the Thrushes when disturbed incubating. Unfortunately there were a couple of twigs and some leaves in the way so I could not repeat the Owl performance and photograph her without the hide.

It was still quite early so we climbed half a mile up the wood to a point where I had remarked signs of activity among the Paroquets (*Psittacula h. himalayana*), so much so that I already had a strong feeling that these birds were perhaps colonial in their breeding habits. Actually I had only marked down one hole which I suspected to be occupied but this quarter of the wood seemed always to be tenanted by Paroquets talking confidentially to one another. This was a circular hole considerably larger than that of a Woodpecker about 18 feet from the ground in the trunk of a deodar.

As we approached I was thrilled to see the head and shoulders of an adult Paroquet protruding from it, so we quickly erected the hide. The slope of the ground was so abrupt that I got the camera comparatively close but even so the lens was tilted at such an angle that the photos I got that day were mere silhouettes against a cloudless sky. The female came back quite soon and stood for some minutes on the perch near the nest and then sidling along the branch levered herself into the hole with the aid of her beak. A woodcutter I sent up the tree said he could make out the edges of two eggs about eight inches to a foot down. On our way back through Sanzipur a fortnight later we could not make out what the hole contained, but the female seemed still to be sitting. This time we built up a platform and erected the tent upon it in the evening; partly so that I could get to work early before the sun got too high in the sky, and partly because birds seem to be less frightened of a new structure erected in a fading light and become quite accustomed to its presence during the hours of darkness. On the way back we faked a dummy hide 7 feet from the Blue-headed Rock-thrushes which now had three young ones in place of the original 4 eggs, and pushed a large black fir cone into the front to represent the lens.

I returned to the Paroquets at 9-30 a.m. They seemed to be getting used to us, for the sitting bird did not leave the hole until we had been there some minutes and I was almost ready to get into the hide. She was back on the perch very soon after I had been left alone, giving me time for only one exposure before she clamboured in. I've called her the female but there was really nothing to go by as to which parent it was.

And now ensued a long wait. My patience started to give out. Nothing happened. The wood settled down to utter stillness but for the tapping of a Woodcutter's axe in the distance, and at last I decided to call up the shikari to shift the sitting bird. Fortunately I hesitated, for a few seconds later my boredom turned to feverish activity. With husky screams a band of Paroquets came twisting through the wood; the next moment my startled gaze beheld no less than five paroquets on the perch and clustered round the hole. There were three adults with bright

yellow tail-tips and slaty faces, and two youngsters short-tailed by contrast and a uniform dull green all over. Were they a neighbouring family escorting the head of the house to his front door? The lady within evidently did not care a hoot who they were and took not the slightest notice. In fact, to begin with I was not sure that she had not slipped away unawares but about ten minutes after the roysterers had taken their departure as noisily as they had come, she poked her head out of the hole, had a look round and slowly withdrew to continue her duties.

First one of the youngsters had a look at the entrance hole, upending himself on a small branch above it and craning his neck to get a better view. But soon one of the adults took possession; perhaps he was the owner. At any rate he seemed the odd man out of the five. I was quickly at work using a so-called silent shutter, which in actual fact made just sufficient noise to attract the audience's attention without frightening them. I was able to take 7 photographs employing short time exposures, as the scratchy noise of the shutter and the slight sounds I made changing plates merely caused them to freeze in grotesque attitudes. Eventually they dashed off for no apparent reason just as suddenly as they had appeared.

To keep all my observations on this bird together I will relate here the remainder of my contacts with them. When we left Sanzipur we first went to Bungus and then back to Nildori. Now Nildori is approximately 8,400 feet. In that locality and at that elevation I never saw a paroquet. It was not until we dropped down into the deodars again that we met with them. Unfortunately I am not sure of the elevation at which these trees recommenced but it was below the 8,000 foot mark. There certainly seems to be a connection between the distribution of the deodar and the Slaty-headed Paroquet in this part of the Himalayas. After the breeding season they certainly spread further afield. Osmaston records them at Gulmarg in August, and Colonel Ward states that in the autumn bands of them visit the side valleys, Sind, Lidar etc. This wandering is undoubtedly correlated with food supply. In many different villages I questioned cultivators about them and always received the same information. They do little damage to the rice but much to the ripening maize and this of course ripens in the late summer and early autumn. They also attack fruit and in the spring the apple blossom.

I had my final proof of their love of company on July 2 when on our way back to Baramullah. At Panzal, 9 miles therefrom and only a few hundred feet above the level of the main valley, the path skirts the lowest rim of the forest. As we left Panzal we cut through a little tongue; it amounted to what in the Plains would be called a *bagh* and consisted mostly of chir pines with about half a dozen very tall birches scattered amongst them. The latter were tenanted by colonies of slaty-headed paroquets—unfortunately I omitted to inspect the pines. On the side facing me of one birch I counted five holes, three of which, definitely occupied ones, were hardly two yards apart. Many of the holes were far from being perfect circles, a few of them being somewhat unsymmetrical ovals with the axes at no particular



SLATY-HEADED PAROQUETS (*Psittacula h. himalayana*)

Regardless of the fact that this delectable residence was already occupied, a party of three adults and two young ones suddenly arrived to inspect it.

angle. They varied in size considerably; from little bigger than that of a Pied Woodpecker through which the birds squeezed with difficulty to about 4 inches across. The lowest was about 20 feet from the ground while some I estimated to be 60 or more feet up. I saw three or four birds entering and leaving holes while all the time there was an incessant screaming from birds conversing with one another or from small bands weaving swiftly in and out of the trees. These bands contained numbers of immature birds and seemed to be family parties whose nesting for the year was over and done with. Watching them was intensely interesting but alas we were on the move and could not afford to stay.

After that digression I must return to the description of this trip in its chronological order. As there seemed to be nothing at the right stage to photograph, on June 11 we decided to move from Sanzipur to Bungus, a large *marg* lying at approximately 9,700 feet under the main slopes of the Kazinag. As the Naugam F.R.H. was but $2\frac{1}{2}$ miles up the valley, we decided to leave it out and do the march in one. Within less than a mile we crossed a wide almost-dry *nullah* bed and walked past the little village of Vihom where I at once noticed that the sparrows flitting about the hedges were cinnamon-headed. It is extraordinary how at times new species appear in numbers with complete suddenness. Entering the shady woods at Naugam we still followed the course of the river for another mile before turning abruptly up the hillside. Birds were few amongst the deodars and little of interest appeared until we suddenly reached the crest of the spur enabling us to look into a broad amphitheatre dotted with widely-spaced pines all of which seemed to have been blasted by lightning or killed by disease; rather a striking sight, especially as soaring majestically heavenwards with but a tiny whisp of cloud trailing from its summit to offset its beauty, there floated over the bowl's further rim the snow-white outline of Nanga Parbat, the unbeaten giant of the Western Himalayas, many miles distant but none the less an amazing sight. To our right I heard the flutelike triple whistle of a Black and Yellow Grosbeak, a bird whose call is as attractive as its brilliant plumage, while the Small Cuckoo was abjuring 'our smoky pepper' from a distant perch.

Following the crest of the ridge in order to reach the first pass into the little valley where lie a couple of Gujar huts and the charming *marg* called Nildori, I suddenly realized we had left the deodars behind and had entered a new bird world. We would then be about midway between 7,000 and 8,000 feet up. Chocolate and white Spotted Nutcrackers became very common indeed but unfortunately pair after pair seemed to be accompanied by their young. I investigated two nests, both 30 to 40 feet from the ground, which agreed well with the description in Volume I of *Nidification*; but the young had obviously left them days before, so I think their nidification must end normally by the end of May. This bird is far more numerous throughout the Kazinag, from a little beyond 6,000 feet up to at least 10,000 feet, than anywhere else in Kashmir, and I am equally sure that no other bird in that State produces more extraordinary noises. Their calls, if one may

use that word, range from wheezy crowlike caws to piggish squeals which they sometimes produce unceasingly for minutes at a time while concealed in the summit of some dense fir.

Tree-Creepers, Tits, Flycatchers, and Grey-headed and Missel Thrushes, now became common. I heard once more the sweet rapid song of the Kashmir Wren, the agitated chucks of the Pied Woodpeckers, and began to note many birds of the higher elevations, but I am sorry to say that when at length we attained the last summit and looked across the great stretch of the Bungus *marg*, we were very disappointed. Rainfall had been excessive and the unbroken stretches of green showed deeper patches of colour where the ground had become little more than swamp so that before we reached the tiny, and I regret to say decidedly draughty, forest hut, we were soaked to the knees, so water-logged had it become. As far as the eye could see sheep dotted the landscape, hundreds upon hundreds of them, not only keeping the grass short-clipped but producing a flowerless land where we had hoped for colour and beautiful blooms. Dwarf irises and a few fritilleries were alone to be seen. The surrounding woods were rather thin with acres of fallen trunks on the flanks of the steeper spurs where the crushing weight of slipping snow had battered them down. There and then we decided to keep on the baggage ponies, stay at the hut for one complete day, and then retrace our steps to Nildori which looked such a charming little spot and certainly far more hospitable—after all we were on leave and supposed to be enjoying ourselves.

The following morning I found a White-capped Redstart (*Chaimarrhornis leucocephala*) sitting on a nest of 4 eggs. It was really somewhat conspicuously placed in the upturned end of a fallen trunk close to an almost dry stony nullah running into the woods behind the hut. The bird sat tight allowing us to inspect her at close quarters. I also found a wren's nest tucked into a crevice in the bark on the underside of a fallen tree and so well concealed from view that it was quite impossible to bring the camera lens to bear upon it. I stuffed up the entrance hole with my handkerchief and then focussed on a fallen stick which the bird used as its final pitch on its way to the nest. I did not get good results, however, as the light was too poor to enable me to cope with its very quick agitated movements. In the evening I was brought a Witherby's Pipit, a female shot off the nest. The 4 eggs were nearly ready to hatch but I eventually managed to blow them.

On June 13 we retreated the few miles to Nildori and pitched our tent at the extremity of the flattened spur at the northern end of the narrow little *marg*. It was a charming little spot, well sheltered on both sides and behind by woods carpeted with sky-blue Jacob's ladders and with a clear view of three 14,000 feet peaks directly ahead. For the time of year these had an inordinate amount of snow upon them.

We were glad to have come down from Bungus. I have described the Kazinag range as a stopper. Almost every afternoon clouds from the direction of Uri would attempt to sweep over their crests into the main valley, and alas we struck a period when



WHITE-BROWED BLUE FLYCATCHER (*Cyornis s. superciliaris*)

The male often fed his mate at the nest, thus relieving her of the necessity of leaving her newly-hatched young.

for the first few days of our life in tents they succeeded in doing so. During the second afternoon we had a terrific downpour accompanied by perfectly deafening thunder. We afterwards learned that it had been the cause of depriving Srinagar of its electricity for a couple of days.

On our way up to Bungus I had noticed a pair of Tree-Creepers (*Certhia h. himalayana*) obviously with young in a narrow slit in the bark of a deodar about a mile from camp. The nest was not more than 7 feet from the ground and close to the path; so off we set at the first opportunity burdened with cameras, the hiding tent, and our tiffin. In direct contrast to a very bold pair I once photographed at Sonamarg, both the parents proved shy. It was an hour before one of them plucked up courage to poke more than its head into view and slither rapidly into the hole with a scratchy sound of its thin claws over the intervening bark.

Slither is the correct term and they slithered about the trunk in such rapid jerky little runs that I found it difficult to get off exposures except by using a large stop and a very short exposure. I have certainly taken better photographs but they show off the close barring of the tail feathers of this species very well.

After about two hours work on the Tree-Creepers, we moved back along the path to an old stump with many rotten little cavities in it. One of these held a minute mossy nest of the White-browed Blue Flycatcher (*Muscicapula s. supercilialis*). This is perhaps the most common Flycatcher in the Kazinag and occurs everywhere in the forests from their lowest levels. I also found two nests in quite small orchards at not more than 6,000 feet. The males are easy to identify in spite of their rather unobtrusive habits as their colour pattern of dark blue and purest white is so distinctive. The upper parts appear blue in their entirety except for the conspicuous white stripes over the eyes, widest and all but meeting on the nape. The blue is continued in a broad collar on either side of the breast which however is always interrupted in the centre to a greater or lesser extent. It is not given to conspicuous flights after insects from a fixed perch like the dull-coloured Sooty Flycatcher but its subdued oft-repeated attempts at a song serve to notify its presence whenever one is sufficiently close to hear them. 'Te-che-prrr' it says, dropping its voice considerably on the 'prrr'.

This couple proved easy subjects with the lens but 7 feet from the nest, coming back within five minutes of my being left alone, the female to brood her microscopic babies, the male to bring food both for her and the chicks. He fed his wife at the nest, apparently relieving her of any necessity of forsaking her charges at such a tender age. On his first visit he presented the very aspect I most desired to portray, showing off his interrupted blue breast band to perfection. Unfortunately to let them get used to the lens and hide I let both of them put in a couple of visits before starting photography, and this turned out to be the only time on which the male did not present his back to me.

On the way home I watched a couple of pairs of Missel Thrushes but could find no nests. The Missel Thrush is a bird of particularly wide altitudinal range in Kashmir, in the breeding

season living in the forest areas from their lower levels at about 6,000 feet upwards and gathering in the late summer and autumn into flocks which find their way to the very limit of the birches at between 12,000 and 13,000 feet. Near the top of the ridge sweet smelling cream columbines were growing.

After this we spent most of our time much nearer home. The wood behind camp was of a very mixed character with clearings here and there dotted with old stumps, bushes and a little juniper. There were also a number of short steep-sided ravines with little trickles and a few muddy patches in their beds. Such country naturally held many species of birds. Tits were scarce, rather to my surprise, but woodpeckers whose nesting was over abounded. Grey-headed and Missel Thrushes were common. I found three nests of the former, one very conspicuously wedged in the first fork where the main trunk of a tree divided about 12 feet from the ground, the other two being, as is so often the case, well hidden in the crowns of young firs. Amongst the bushes in the clearings I found nests of Meadow Buntings, two Jerdon's Hedge-Sparrows, a Blue Chat's, and a Streaked Laughing Thrush's with two young ones in it. This last nest was very bulky for the size of the bird, a somewhat loose structure of dead grasses. Willow-Warblers of course abounded, particularly Ticehurst's (*Phylloscopus proregulus simlaensis*), which I learned to trace to its almost invisible little nest in the ends of the fir branches by listening for its sharp monosyllabic 'Tsip' and then watching it carefully to its lair.

The Hedge-Sparrows we left alone as we had one on an outer branch of a fir not 20 yards from the tent door. I photographed the female on this. It was a beautiful structure, a foundation of quite stout sticks padded with quantities of moss with a thick felted lining of wool, hair, and a few feathers. The whole was intermixed and covered with a layer of a stringy almost white lichen. The female was most amazingly tame and sat on while we raised the sheltering branch immediately above and tied it back out of the lenses' vision, after which I took long-time exposures of her with the silent shutter.

How many people realize that Jerdon's Hedge-Sparrow is no mean songster, its lay being not unlike a Wren's but not so boisterous and penetrating.

Late one afternoon we sauntered along the flank of one of the short ravines. As we neared its head the forest closed in, so, finding it rather gloomy in the fading light we crossed over to return on the other side. It was then that we had one of those outstanding experiences of a lifetime, something to be looked back upon in years to come as an episode never to be forgotten. As we made our way through some bushes on the edge of a more open grass-carpeted slope there arose a strange croaking. First I thought it the production of Nutcrackers but it came from the ground hardly 20 yards away. We called in the Cocker spaniel and pushed forward. I was rapidly coming to the conclusion that a hawk or owl had got some luckless victim in its talons, when my wife shouted that two large birds had left the ground just in front of her and were flying downhill towards the bed of the nullah. I emerged from the bushes just in time to see a pair of Woodcock



JERDON'S HEDGE-SPARROW (*Prunella strophinata jerdoni*)

The soft nest of moss, thickly lined with hair and a few feathers, was plastered with almost white lichen.

(*Scolopax rusticola*) wheel into some cover near the boggy stream below. But where was that easy almost owl-like flight? They flew heavily with tail spread wide, seemingly weighed down behind. And they kept up that strange croaking even after pitching into cover.

We tied up the dog and I started down the slope. Suddenly croaking broke out anew hardly 15 yards below. One of the birds had returned while my attention had been taken up with the dog. I saw a Woodcock on the ground. Its wings were spread wide with the tips drooping into the grass, the tail fanned out, and the body upraised at about 45° with the bill pointing downwards. Croaking and groaning harshly as I rushed towards it, it started into flight, but it was evidently unable to use its legs for the take off so that it dragged down the slope for a yard or two beating the earth with its wingtips before getting clear. Even while flying its body remained at the same awkward angle and it rose but a few feet off the ground coming heavily to earth 30 yards further down.

This time I made a still greater effort to catch it in an attempt to elucidate the cause of its strange antics. I could have laid it low with my khud stick, but it just got clear as I stretched out a hand to seize it and succeeded in crossing the nullah where I lost all trace of it.

I think it is now taken as an established fact that Woodcock do carry their young for two purposes, namely to get them to distant feeding grounds and to remove them from danger. I have read various accounts at different times but there are still those who contend that a point still at issue is the actual method of carriage. Unfortunately in this instance the birds throughout were facing away from me, making it quite impossible to see not only the method of transportation but any burden whatsoever, though of course it was quite obvious that they were carrying something. And does this croaking always take place as a matter of course or was it the sudden entrance of our spaniel which caused the commotion?

Nildori provided so many points to explore that even at the end of ten days I felt that we knew but few of its treasures and still had half a dozen potential photographs in view. But a very large slice had already been taken out of our month so we felt it to be time to move to fresh fields.

We returned to Sanzipur on June 21 stopping there two nights to cope with the Slaty-headed Paroquets. After finishing with those interesting birds, I moved the tent to the Blue-headed Rock-Thrush's (*Monticola cinclorhyncha*) nest in front of which I had previously erected a dummy hide. It now held three well-nourished young ones in place of the original four eggs.

It is just 20 years since I first attempted to photograph this beautiful but allusive Thrush. Anyone who has come upon a nest and has noticed the outraged demeanour of the female thereon, sitting as if nothing short of a forest fire would force her to leave, would imagine that there could be no easier prey for the bird photographer. Unfortunately there are few birds' nests in front of which one can just put down the camera and get busy. There

is almost always grass or leaves or some obstacle requiring removal to give the lens a clear view, and once flushed off the nest I have never yet met a more suspicious nature than is possessed by both sexes of this rather common bird.

On this occasion I used an almost silent 'luc' shutter in the extension box on the front of the reflex, and was gratified to hear almost immediately one of the birds in the parrotia scrub close to the right side of the tent. Suddenly it flew straight to the nest and there I beheld the blue and chestnut male standing in strained silence upon its rim while the young ones clamoured for food. I had set the silent shutter for brief time exposures, not venturing to use the clattering focal plane. I pressed in the release letting it go again almost as quickly as I could thereby giving about one quarter of a second. The slight scratch of the shutter leaves caused him to listen intently so that I dared not attempt to change the plate. Full of suspicion he eventually flew off without feeding his babies and that was the very last I saw or heard of either bird. One slight scraping noise had been sufficient to convince both of them of the worst. Still, although I possess only that one negative of the male, I can hardly complain.

My next encounter with this species came a few days later at Kiterdarji, our last resting place. It is only about half a dozen miles from Sanzipur and about the same elevation. To reach it we crossed a couple more of the charming tributaries of the Pohru river, since we made our way directly across the lower spurs of the Kazing. The country was lovely; forest glades and parkland alternating with fields of ripe corn, acres of linseed nearly as blue as the sky, over which the larks rose and fell singing their loudest, while at the lower levels the rice was being planted out to the accompaniment of the monotonous yet fascinating chants of the peasants.

This time the Rock Thrush's nest was balanced on a narrow ledge on a decaying stump. It was quite open to view and close to a cattle track through the forest. When first discovered the female continued to sit on her newly-hatched triplets as still as a rock seemingly as bold as any bird could be, yet to get a glimpse of either bird, even from afar, visiting the nest with food was quite impossible. First I left a dummy hide in place for a couple of days and the real one for the best part of another twenty-four hours. When I got inside I waited patiently for an hour and a half but nothing happened. I had taken the greatest care in entering the hide, getting the shikari to stand close to me while I went in through the back. Halfway through the morning I took a short time off in order to try a new dodge. On my return my wife and the shikari both tucked me in and went off carrying an empty coat between them. Now, can these birds count? Or was it sheer coincidence that the male should fly straight to the nest not five minutes later, and almost immediately afterwards the female, seeing the rim of the nest occupied by her husband, landed on a dead stump midway between the lens and the nest so that she was hardly three feet from me.

I was disappointed with my view of the bird at the nest. He squeezed in too close to the trunk with his back to the camera, so



BLUE-HEADED ROCK-THRUSH (*Monticola cinclorhyncha*)

Comparatively common and extremely widespread, this beautiful bird is excessively cautious in its approach to the nest.



BLUE-HEADED ROCK-THRUSH (*Monticola cinclorhyncha*)

So very soberly arrayed in comparison with her brightly dressed husband.

as soon as they had both gone I turned the lens on to the stump. Shortly afterwards the female returned, but to my complete disgust she flew straight to the nest and settled down looking directly at me. I don't suppose she could see anything but I had an awful feeling that she was looking straight through the peephole at my left eye. For half an hour I attempted to emulate the proverbial mouse. Fortunately a noisy individual with some cattle and goats came on the scene and off she went. Twenty minutes went by and then suddenly her image seemed to fill the whole focussing screen. There she was standing sideways on the stump eyeing the hide; in fact a glance at the illustration shows a tiny image of it in her pupil. Cautiously I pressed the release and gave an exposure of a good three seconds. She flew to the nest so I started to change the plate. At once she froze and I perforce did likewise, the result being that for perhaps 10 minutes, which seemed more like an hour, we maintained the most uncomfortably strained attitudes; she with her head twisted sideways looking over her shoulder, and I trying to preserve a precarious balance with my hands full of plate-holders and my feet all over the place, as the camp stool had slipped on the steep hillside—their nests so often seem to be on steep hillsides!

A bird which I found extremely common throughout the lower parts of the Kazinag forests was the Rufous-tailed Flycatcher (*Alseonax ruficaudus*). One of the most unobtrusive of the whole family both as regards its colouration and its habits which are really somewhat chat-like, it would often escape notice were it not for the incessant complaining note 'Peup' which it utters incessantly when one is anywhere near its nest. I found we had a typical nest close to the Kiterdarji Forest Rest House, a rather large pad of moss plastered on to the upper side of a fork of a horizontal branch of a fir tree. It was about 15 feet from the ground and 7 feet out from the trunk. From directly below it was quite invisible but from either side it showed up clearly as a substantial compact excrescence, considerably larger and far less symmetrical and neat than that of the Sooty Flycatcher. There were three typically spotted young ones in it nearly ready to fly. I had no difficulty whatsoever in getting photographs from the hide placed on a platform laid across two very convenient horizontal branches sprouting from the opposite side of the trunk. I found the parents had varied notes for their arrival at the nest, sometimes uttering a soft 'chur' and sometimes a double 'te-peup', the danger note preceded by a short 'te'.

Indian Red-Breasted Flycatchers (*Siphia parva hyperythra*) were common here. In other nullahs I had seen very few, one or two near the Naugam F.R.H. but none at elevations above 7,000 ft. Their breasts were such a deep brick-red that in order to make certain of the race I'm afraid I succumbed to shooting one pair which had still got eggs in a Woodpeckers' disused boring. I also saw more Green-backed Tits (*Parus monticolus*) in the Kazinag than I have seen elsewhere in Kashmir. They seem to be very much of a forest bird whereas the Grey-backed Tit is more a bird of the orchards, willow groves, and hedge rows.

Most of these little valleys had a pair or two of Kashmir

Rollers (*Coracias garrula semenovi*). One pair were always visiting the Rest House not far from which they caught frogs and large grasshoppers and flew off with their prizes to somewhere beyond the village, about half a mile away. Eventually I found they had three small young ones and an addled egg in a large cavity in a tall willow tree just beyond it. We managed to build up a platform for the hide on the very summit of an adjacent apple tree.

They were bold birds but not half so noisy and acrobatic as their more brightly plumaged cousins of the plains. There were two holes above the nest one of which was very small while a third one, lower down and the largest, directly faced the camera. It soon became evident that the birds had a fixed routine, entering by the larger of the top holes and coming out through the one in front of me. This arrangement did not suit at all as I got a tailend view each time a bird entered and they left without pausing on the rim of the large hole.

After a few attempts I had their normal entry hole stuffed up with a coolie's puggri. The result was quite ludicrous. One of them arrived with a large frog in its beak. For more than ten minutes it alternated between standing forlornly on the puggri and trying vainly to force its shoulders through the small hole near it. Eventually it swallowed the frog and flew away. It seemed quite incapable of appreciating the fact that it could get in through the hole by which it usually came out. At last the other bird appeared. At first it seemed just as much at sea as its mate but all at once light dawned upon it with such celerity that it popped in without giving me time to press the release. Shortly afterwards the male again arrived with a frog, going through the same performance as before except that he flew off to their favourite perch still with the food in his bill. This was doubly unfortunate as they seemed to feed the young ones in strict rotation so that the female promptly refused to come near until she thought he had done his bit. He wasted twenty minutes in flying backwards and forwards before he guiltily scoffed the frog himself whereupon the wife at once condescended to come once more. This time I was the one at fault: she stood so still across the top of the hole that I could not resist taking her portrait with the result that when she suddenly flew down and clutched its bottom rim with her tail spread out across the bark in the very attitude I had visualised, I was in the act of changing the plate. Thereupon feeling that all three of us were being equally futile I went home in disgust to pack up in readiness for the next day's march to Baramullah.



INDIAN RED-BREASTED FLYCATCHER (*Siphia parva hyperythra*)

The entire underparts appeared a deep brick red as the male left the nest-hole, while the female was only slightly less bright and lacked the dark stripes down the sides of the neck.

THE SLENDER LORIS OF THE HORTON PLAINS, CEYLON.

Loris tardigradus nycticeboides, subsp. nov.

BY

W. C. OSMAN HILL, M.D., F.L.S., F.Z.S., ETC.

(With plates)

The recent demise of a pair of Slender Lorises obtained originally in May 1938, by Mr. A. C. Tutein-Nolthenius from the Horton Plains, (altitude 6,000 feet) in central Ceylon, enables me to supply a descriptive account of them under a new subspecific name. That the animal is rare in that locality is evidenced by the fact that Mr. Tutein-Nolthenius had been on the look out for it for the previous twenty years without success. The pair was forwarded to Colombo immediately and kept in captivity by Dr. L. Nicholls until August 1940, when they were transferred to my own collection. During their sojourn with Dr. Nicholls the female gave birth to two young, one in December 1938 and another in May 1940. An account of the earlier pregnancy and gestation period has already been published by Nicholls (1939). Both young died, the first, a male, at the age of one year and the second, also a male, whilst still an infant. Both have been used in compiling the present contribution. A week after the two adults were deposited with me the female collapsed suddenly and died. A half-term gestation sac was discovered in her vagina. The male died of hepatic disease about a week later. The skins and skeletons of both were preserved.

When first received in 1938 these Lorises were noticed to be remarkably fine animals, large in size and with exceptionally heavy pelage, which, with the apparent relative shortness and stoutness of the limbs, especially the hind pair, gave to them the aspect of small Slow Lorises (*Nycticebus*) Nicholls (loc. cit.) had referred to them as extreme types of *Loris tardigradus grandis*, Hill and Phillips (1932), the form recorded hitherto only from altitudes of about 3000-3500 feet, but it was clear on further examination that if *L. t. grandis* was worthy of subspecific status, then these Horton Plains examples were very much more deserving of separate treatment. Typical *grandis* is intermediate between the present animal and the common lowland animal *L. t. tardigradus*, but at present there is a wide altitudinal hiatus between 3500 and 6000 feet from which no specimen has yet been obtained. Meantime it is considered best to treat the Horton Plains examples as a new sub-species for which the name *nycticeboides* is proposed, in allusion to the resemblance to the Slow Loris referred to above.

Loris tardigradus nycticeoides, subsp. nov.*Type.* ad. ♀ from Horton Plains, circa 6000 feet, Central Ceylon.

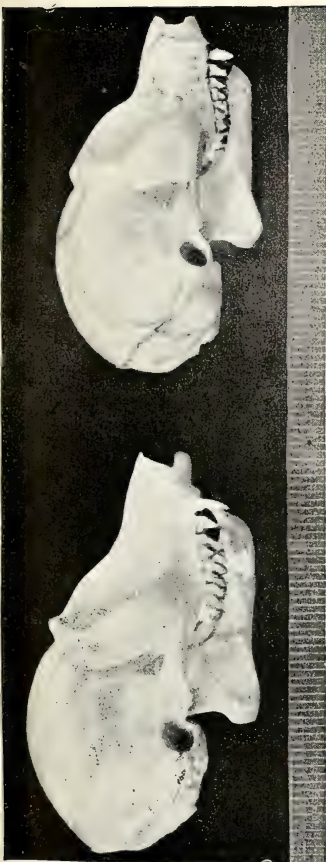
I. MEASUREMENTS.

TABLE I. General Bodily Measurements of *Loris tardigradus nycticeoides*

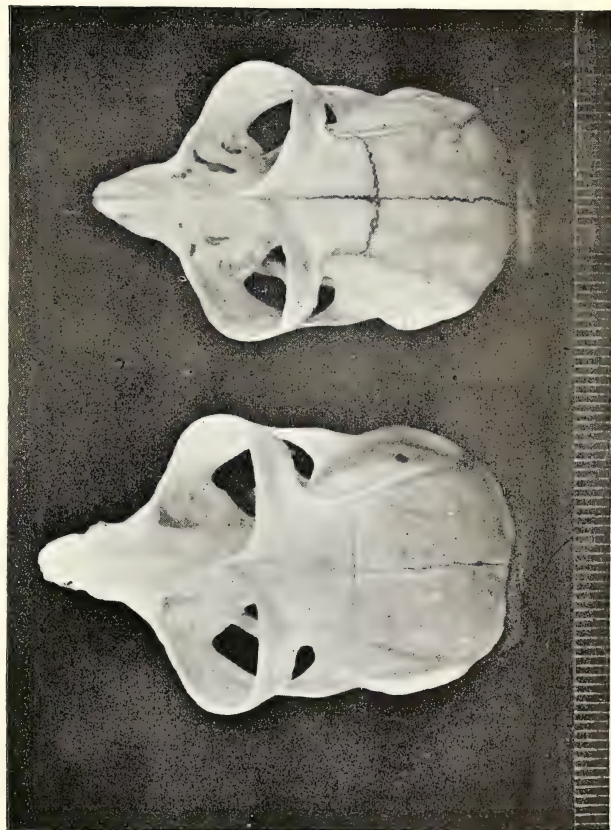
	♀ ad. Type	♂ ad. (para-type)	♂ 1 year old	♂ infant
Body weight	150 gm.	140 gm.	...	...
Length of head and body ...	213	204	199	93
Length of head ...	57	52	53.5	40
Length of ear ...	26	25	23	14
Bimalar breadth ...	33.5	32	35.5	22
Nasion-rhinion ...	19	17	15	10.5
Width of palpebral fissure ...	16	14	15	8.5
Height of palpebral opening ...	12	10	11	...
Bisacromial breadth ...	55	38	44	25
Length of brachium ...	69	59	45.5	26
Length of antebrachium ...	70	66	62	35
Length of hand ...	27.5	33	31	17
Bitrochanteric breadth ...	38	33	35	16.5
Length of thigh ...	66	63	50	34
Length of crus ...	67	66	63	37
Length of foot ...	47	47	46	29
Length of phallus ...	10	11	16.5	6.5

TABLE II. Measurements of Digits of *L. t. nycticeoides*

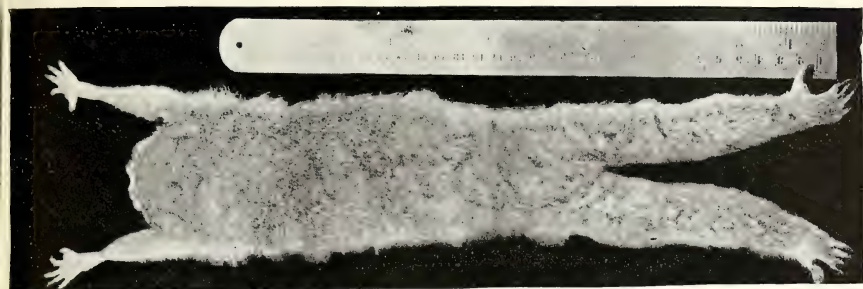
Measurement	♀ ad. (Type)	♂ ad. (para-type)	♂ 1 year old	♂ infant
	mm.	mm.	mm.	mm.
Radial styloid to tip of pollex ...	17	13	13	10
L. of index ...	6	10	10.5	8.5
L. of medius ...	11.5	13	14	10.5
L. of annularies ...	11	14.5	14.5	12
L. of minimus ...	10	11.5	12.5	9.5
L. of hallux ...	20	22.5	21	13
L. of second toe ...	6	6	15	4.5
L. of claw on above ...	6.25	6	4	4.5
L. of third toe ...	13	15.5	14	7
L. of fourth toe ...	15	18.5	17.5	9.5
L. of fifth toe ...	14	17	16	8



1. Skulls of *Loris tardigradus nyciceboides* (left) and *L. t. tardigradus* (right) in *norma lateralis*.



2. Skulls of *Loris tardigradus nyciceboides* (left) and *L. t. tardigradus* (right) in *norma verticalis*.



Loris tardigradus nyciceboides subsp. nov. (Type ad. ♀). Horton plains, circa 6000', Central Ceylon.

TABLE III. Limb-Indices of Lorises*

Index	<i>L. t. nycticeboides</i> ♀ ad. (type)	<i>L. t. nycticeboides</i> ♂ ad. (paratype)	<i>L. t. nycticeboides</i> ♂ 1 yr. old	<i>L. t. nycticeboides</i> ♂ infant	<i>L. t. grandis</i> ♀ type	<i>L. t. grandis</i> av. of 2 ad. ♂♂	<i>L. t. tardigradus</i> av. of 4 ads.
Fore-limb—trunk index ...	83.5	82	74	115	84	88	93.5
Hind-limb—trunk index ...	85.5	85	78	134	85	96	107.5
Intermembral index ...	98	97	95	86	88	92	86
Humero-radial index ...	116.5	112	136	134	114	117	145
Femoro-tibial index ...	102	105	126	109	110	105	106

* Hand and foot have been excluded in calculating the limb indices.

The following inferences may be drawn from a perusal of the preceding tables. In the Horton Plains Loris the limbs are relatively shorter in reference to the trunk than in any of the other races dealt with. The hind limb is especially shortened. These differences are not noted in the new-born individual, which retains the proportions noted in the other races. The lowland animal differs most from *nycticeboides*, *grandis* being intermediate. The intermembral indices elicit similar deductions; but the humero-radial and femoro-tibial indices present no significant differences among the forms studied.

II. PELAGE.

(a) Type ♀.

The fur is very long, soft and thick causing the animal to look much larger than its actual bodily measurements would suggest. This is particularly true of the limbs, which are thickly furred towards their extremities, especially the hind pair. Hairs on upper back measure up to 25 mm. long, and on ventral surface up to 30 mm.

General colour of upper surface brown, with no reddish tinge, slightly darker on crown, nape and upper back, much paler on lower back and hind limbs. Bases of hairs plumbeous grey followed by buffish zone, and finally with brown. Some of the longer hairs on shoulders and upper back are tipped with buff, but there is no white frosting anywhere. Ventral surface from chin to upper abdomen buff. Belly more ochraceous. Hairs grey at the base, except on a collar across the lower throat, where the long hairs are light buff throughout. Anterior to this the bases of the hairs are pale grey and the tips light buff (cf. the white throat of *L. t. grandis*). Posterior to the collar the bases of the hairs very suddenly assume a dark grey tinge, which gradually darkens posteriorly.

Interocular white stripe narrow, enlarged on forehead and continued round very dark, almost black circumocular areas. Hairs on cheeks tipped with white. Eyelashes well developed, long and black. Muzzle with a few short dark brown hairs. Ears densely

clothed with greyish-brown fur. Arms paler than back, especially on flexor aspect and towards distal end. Hand clothed with short, sparse white hairs, except on distal phalanges. Hind limbs similar to lower back, but a little paler distally and on flexor surface. Foot more heavily clothed with white fur than hand, with sharp line of demarcation at ankle.

(b) *Adult male.*

Similar to the female, but smaller and slightly darker in colour; the dark brown of the upper back extending farther backwards, and the basal grey zone of the dorsal hairs being of a darker tint. Ventral aspect similar to the female, but all the hairs of the throat are uniformly buff. Face, ears and limbs as in female.

(c) *Infant male.*

Dorsal surface dark grey with a slight surface wash of brown, paler on limbs especially flexor aspects and more distal parts. Ventral surface including throat dirty white. Circumocular areas chestnut, surrounded above and laterally by a zone of white-tipped dark grey hairs. White tips most marked in preauricular region. Muzzle whitish. Ears more scantily haired with long dark grey hairs than in adult. Hands and feet also less heavily furred.

III. SKIN PIGMENTATION.

Naked part of rhinarium pink, but hairy part of muzzle has a little dusky pigment. Eyelid margins and margin of nictitating membrane deeply pigmented, the pigment sometimes extending a little way on to the conjunctival surface. Rest of conjunctiva unpigmented. Ears pigmented a little towards their free margins. Lips, hands and feet show no appreciable pigment in the adults, but the dorsum of the hand and foot are somewhat dusky in the infant, the edge of the pigmented area being sharply defined from the pallid surface of the palm and sole. Honeycomb pigmentation of scrotum of rutting male very slight and confined to the posterior aspect of the sac.

IV. SKULL.

Although the somatic measurements indicate that the present race of *Loris* is no larger than specimens of *L. t. grandis*, despite its apparently greater bulk during life, the above table shows that the skull is definitely greater than in *grandis* in many of its dimensions. The cranium is appreciably longer, but narrower than in *grandis* or *tardigradus*. The breadth across the bullae, however, is greater than in either of the preceding forms. The palate is shorter, but wider, and the mandible slightly smaller accordingly. The osseous snout is somewhat more prominent than in the other races, and this is associated with considerably larger anterior palatine canals. Ethmo-maxillary fossae, which have been previously (1933) shown to differ among the different races of *Loris*, are here equally distinct, being relatively larger than in any of the previously known forms and almost oval in shape. The thin flange of bone forming

TABLE IV. Cranial measurements of *Loris tardigradus nycticeboides*.

Measurements	<i>L. t. nycticeboides</i> Type ♀	<i>L. t. nycticeboides</i> Para-type ♂	<i>L. t. grandis</i> av. of 3	<i>L. t. tardigradus</i> av. of 7
	mm	mm	mm	mm
Maximum cranial length ...	52.5	54	51.9	48.6
Maximum cranial breadth ...	26	26	29.25	30.3
Skull height ...	22	21	...	...
Minimum cranial breadth behind orbits ...	18	...	16.6	17
Least frontal breadth ...	14	15	...	...
Breadth across bullae ...	30	30	29	27.8
L. of foramen magnum ...	6.25	...	...	...
Br. of foramen magnum ...	6.5	...	...	...
Palatal length ...	18	...	19.3	17.5
Breadth across m 3 ...	16	17.5	15	14.7
Upper tooth row ...	16	16	16.8	15.3
Bizygomatic breadth ...	32.5	32	...	...
Interorbital breadth ...	1.25	1.5	...	...
Condylion-symphysion ¹ ...	26	27	28	27
Mandibular ht. (at condyle) ...	11	10	...	...
Mandibular ht. (at coronoid) ...	17	...	...	...
Lower tooth row ...	13	12	15.6	14.8

the lateral boundary of this fossa in the floor of the orbit is extremely attenuated and quite transparent giving a free view into the maxillary antrum. The temporal ridges are very prominent, approaching within 14 mm. of one another on the frontal bone and then receding gradually until they are 25 mm. apart where they join up with the lambdoid crest. In the mid line of the squamous portion of the occipital bone the external occipital crest, after an initial 2 mm. swells up to form a sugar-loaf-shaped vertical torus, the base of which extends down to the foramen magnum and fills up the whole of the space between the two occipital condyles. This torus is present in the other races, but in a much reduced form compared with its appearance in *L. t. nycticeboides*.

SUMMARY.

A new race of Slender Loris superficially resembling a Slow Loris is described from the Horton Plains, (alt. 6000 feet) in Central Ceylon. The description is based on an adult pair and two of their offspring.

The race is nearest in most characters to the previously known *L. t. grandis*, but differs in its appendical proportions and in coat characters. Although not exceeding *grandis* in its general bodily size, the new race has a larger head, and shorter limbs, the hind pair being especially affected. The coat is exceedingly thick and long and clothes the limbs more fully than even in *grandis*. It differs in colour from *grandis*, approaching nearer to *tardigradus* in this respect, though lacking any erythrastic tendency.

In conclusion I have to tender my warmest thanks to Dr. L. Nicholls for having handed over to me the material, both living and preserved, upon which the above account is based.

REFERENCES TO LITERATURE.

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 Nicholls, L., 1939 *Nature*, cxliii, p. 246.

EXPLANATION OF PLATE.

- Fig. 1.—Photograph of the prepared skin of the type female of *Loris tardigradus nycticeboides*, subsp. nov.
 Fig. 2.—Photographs of the skulls of (a) *Loris tardigradus nycticeboides*, adult female, (b) *L.t. tardigradus*, adult female. Upper figure in norma lateralis. lower in norma verticalis.

FISH OF POONA.

BY

CAPT. A. G. L. FRASER, I.M.D.

PART I.

*General Account and Descriptions of Localities with Lists of
Fishes Collected from each.*

INTRODUCTION.

At the request of Mr. S. H. Prater, Curator, Bombay Natural History Society, and Dr. S. L. Hora of the Zoological Survey of India, I undertook to get together a collection of fishes from the Poona waterways. Mr. Prater very kindly obtained for me the necessary permits to fish in the lakes in the area.

The collection was begun on 15th September 1936 and continued over a period of eight months. Weekly excursions were made, generally on Sundays, and various points of the Mutha-Mula river, as also lakes Fife and Pashan, the tanks at Katraj, and the right bank canal were visited. Altogether 34 batches, collected from 19 localities which in the count total 2851 specimens of various species were secured. As regards the number of species, it would appear that local fishermen recognize 143 different species. This number I consider is greatly exaggerated. In the collection, however, according to the vernacular names given by a fisherman, there are 111 species. This number is subject to investigation and correction by Dr. Hora¹.

It is much regretted that I was unable to visit the outlying lakes, namely Mulshi and Whiting, and the river Indrayani. The collection I think represents in a fair way the fish fauna present in the Poona district waterways as a whole. The Indrayani being a tributary of the Mutha-Mula river, it can be assumed that the fish in it are also fairly represented in the collection made.

The fishes obtained from the lakes are hardly representative, in that only a few species were secured, and there are no examples of the larger carps and game fishes. The reason for this is because the great depths of the water in the lakes rendered impracticable the use of the bell-shaped casting net ordinarily used by fishermen, and by this means only small fry were obtained from the shallow parts near the beach. Trolling all day in a boat with rod and line and using all kinds of artificial, live and other, baits, including a range of bright and dull spoons, drew blanks at three separate

¹ Dr. Hora and Mr. Misra have identified 53 species in the entire collection which was sent to the Zoological Survey of India for determination. I am indebted to them for their kindness in this matter. A systematic list of the species will be published in the second part of this series of articles.

visits to Lake Fife and two to Pashan. In the experiences here with rod and line I found that the river Mutha-Mula, especially in the stretch above the Bund Garden, and around Kirkee near Holkar bridge and at the junction of the two rivers Mutha and Mulla, locally known as the Sangam, offers better scope in the way of sport to the angler than the lakes. The game fishes in the river readily take baits of any kind, particularly if trolled from a boat between the bank and midstream. This I think is because there are no restrictions to fishing, except in a few reserved sections, and fish are angled for with rod and line by numerous enthusiasts who bait their pitches and line the banks everywhere. On the other hand fishing in the lakes is prohibited except to a privileged few. It is a singular fact that the big game fishes cannot normally be netted by fishermen midstream in the river Mutha-Mula, where only small fry can be taken. The larger carps can be netted and hooked during the day between the bank and midstream. As regards the lakes, I have seen huge carps in the middle of the lake leaping out of the water particularly during the early morning and late in the evening.

GENERAL ACCOUNT.

The Mutha-Mula river is by far the largest and broadest river in the Poona district area. A singular feature noted is that the tributary *nallahs* which I encountered here are dry. In the Deolali area perennial streams fed by springs are more the rule than an exception. The Mutha river begins in the hilly region above and around lake Fife, which has been created by the damming of its waters by masonry constructions resulting in the formation of a huge catchment area about 10 miles long and on an average $\frac{1}{2}$ mile broad. The river continues its course from below the dam, but as the larger volume of water is released into the right and left bank canals, comparatively very little water passes through the river bed itself. The lake is eleven miles by road from Poona. It lies at an altitude of roughly 2,000 feet above sea level. The Mula river is fed by the waters from lake Mulshi which lies at an altitude of 1,900 feet above sea level, and it is 40 miles distant from Poona. Both these rivers descend to a level of 1800 feet at their junction near to Wellesly bridge. This junction is known as the Sangam. The Mula is a broader and deeper river than the Mutha and in the section around Kirkee and Holkar bridge there is undoubted evidence of the presence of some very large members of the carp family. The broadest and deepest section of the combined rivers is from the Sangam to the bund near Fitzgerald bridge. This stretch is roughly 2 miles long and $\frac{1}{4}$ mile broad and runs in a slightly north-easterly direction. In it a variety of fish fauna exists. The banks average 15 to 20 feet above the water level and the average depth of the water must be at least 15 feet. The south bank is heavily wooded throughout except in a few certain sections. The north bank is sparsely wooded in parts and for the greater part is bare of vegetation. The south bank is partly rocky, but the greater lengths of it are earthy. On the other hand the north bank is practically rocky throughout and partly earthy only in certain sections. This accounts for the absence of vegetation on the one bank as

compared with the profuseness of it on the other. The flora consists of Babul principally, Tamarind, Mango, Pipal, Gold Mohur and a variety of other trees. The south bank is more covered with grass and rushes near the water's edge. During the monsoon (15th June to 15th September) the river rises, particularly at the end of June by at least 15 to 20 feet and in certain areas overflows over the south bank and inundates the adjoining lands. The volume and flow is then very considerable and the bund near the bund garden is completely covered, the water rising to a little over half the height of Fitzgerald bridge which is about 40 feet high. Usually at the end of the second week of July the river subsides, but the force and volume of water are still great and turbulent. The bund near the bund garden is now visible and there is a fall of about 2 feet into the seething waters below. At this time I have seen large fish gaining access to the reach above the bund by successfully leaping upstream over the fall. Fishing in the early phase of the monsoon is practically impossible, but when the waters have subsided about the end of July the fishermen are able to place nets in the area below the bund despite the turbulence of the water. This is because they have built up walls of stone up to the level of the bund and by this means are enabled to use their particular type of nets which are strongly made in the shape of elongated sacks with a mesh of $1\frac{1}{2}$ inches. One end is very wide, and the other narrows down to a point which is effectively sealed up with gunny sacking. The subsidence goes on, and by October the flow over the bund has greatly decreased and areas of the rocky base below it become visible. By December there is very little water falling from the bund, and by the middle of January this ceases except for a small rush of water near to the bund garden end where there is an outlet in the masonry construction which allows of this. The stretch for $3\frac{1}{2}$ miles below Fitzgerald bridge is rocky throughout with large basalt boulders some of which are 15 feet high. The main river bed proper is as wide as the reach above the bund, and during the rains is completely covered with raging storm waters, but in the dry weather the rocky nature of the bed is exposed and this is interspersed with earthy patches which are grass grown and in parts are rank with rush and other aquatic plants. The banks proper are identical in their features as those described in the stretch above the bund, except that the south bank is less wooded and the trees here are all babul. The main presentation here is that during the dry season of the year there is a sluggish flow of water through narrow channels in the higher parts of the run. In the deeper sections large pools are created with an average expanse of 40 to 50 yards and a depth in the deepest parts of 4 feet. In the portions where there is a fall in the gradient the current is moderately strong, but generally in the months of February to May a stagnation of the water is evident. From December onward the whole of this area is choked with algae. During the latter end of April and May the whole of the river presents a peculiarity which is unique. Then the surface of the water, in parts of the upper reach above the bund as far as Kirkee is, completely covered by a floating aquatic plant, which presumably is a species of duck-weed, so profuse and rapid is its growth that at times the whole expanse is completely grown

over with it to the extent that it has to be cleared to allow of the working of ferry services and contractors rafts on which sand is carried from one bank to the other. The section below the bund is particularly rank with the weed and fishermen have to suspend operations during this time and are compelled to go down the river as far as Manjri and further afield to earn a living. In the pockets near the banks where this weed is held up it becomes a menace to the health of residents in the locality because of the facilities it affords to mosquitoes for breeding. Mosquito larvae, particularly Anopheline, were found in the collection of water in between its petals which form a rosette. Small wading birds are able to stand and walk about on it, especially in the heavy collection which gathers immediately above the bund.

The various batches of fishes were placed in serial order of the dates on which each was secured. The Hindi names of the many species were given to me by a 'Pardeshi Boie'. The Mahratti names have not been given, as in the naming of fishes there is a great variance and discrepancy existing amongst Mahratta fishermen. The 'Pardeshi Boies', as they call themselves, a great many of whom have been fishing in these waters for many generations, are more consistent and accurate in the Hindi names by which they differentiate the species. These local names are included in the list of species which will be published in the next part of this series of articles.

DESCRIPTIONS OF LOCALITIES WITH LISTS OF FISHES COLLECTED FROM EACH.

1. Below Fitzgerald bridge. 15-9-1936, 4-10-1936, 13-11-1936, 31-1-1937, 18-2-1937, 28-3-1937, and 10-4-1937.

This section is rocky for the main part. The depth of the pool averages 4 feet, and it has a wide expanse of 50 to 60 yards. There is a fair volume of water rushing through with a moderately strong current midstream. The water is somewhat turbid.

i.	<i>Notopterus notopterus</i> (Pallas)	...	14 specimens.
ii.	<i>Anguilla bengalensis</i> (Gray)	...	1 specimen.
iii.	<i>Chela boopis</i> Day	...	22 specimens.
iv.	<i>Chela clupeoides</i> (Bl.)	...	77 specimens.
v.	<i>Chela phulo</i> (Ham.)	...	225 specimens.
vi.	<i>Danio aequipinnatus</i> McClell.	...	1 specimen.
vii.	<i>Rasbora daniconius</i> (Ham.)	...	2 specimens.
viii.	<i>Barbus (Puntius) chola</i> (Ham.)	...	4 specimens.
ix.	<i>Barbus (Puntius) Jerdoni</i> Day	...	13 specimens.
x.	<i>Barbus (Puntius) kolus</i> Sykes	...	14 specimens.
xi.	<i>Barbus (Puntius) sarana</i> (Ham.)	...	7 specimens.
xii.	<i>Barbus (Puntius) ticto</i> Ham.	...	1 specimen.
xiii.	<i>Barbus</i> (Tor) <i>khudree</i> Sykes	...	14 specimens.
xiv.	<i>Cirrhitina fulungee</i> (Sykes)	...	5 specimens.
xv.	<i>Garra mullya</i> (Sykes)	...	48 specimens.
xvi.	<i>Labeo boggut</i> (Sykes)	...	5 specimens.
xvii.	<i>Labeo potail</i> (Sykes)	...	16 specimens.
xviii.	<i>Mystacoleucus ogilbii</i> (Sykes)	...	7 specimens.
xix.	<i>Rohitee cotio</i> var. <i>cunma</i> Day	...	12 specimens.
xx.	<i>Rohitee neilli</i> Day	...	2 specimens.
xxi.	<i>Rohitee vigorsii</i> Sykes	...	19 specimens.
xxii.	<i>Lepidocephalus guntea</i> (Ham.)	...	1 specimen.
xxiii.	<i>Nemathilus botia</i> var. <i>aureus</i> Day	...	9 specimens.

xxiv.	<i>Nemachilus dayi</i> Hora	...	7 specimens.
xxv.	<i>Callichrons bimaculatus</i> (Bl.)	...	2 specimens.
xxvi.	<i>Callichrons pabo</i> Ham.	...	3 specimens.
xxvii.	<i>Mystus cavasius</i> (Ham.)	...	12 specimens.
xxviii.	<i>Rita hastata</i> (Val.)	...	4 specimens.
xxix.	<i>Rita pavimentata</i> (Val.)	...	4 specimens.
xxx.	<i>Gagata itchkeea</i> (Sykes)	...	9 specimens.
xxxi.	<i>Glyptothorax lonah</i> (Sykes)	...	2 specimens.
xxxii.	<i>Proeutropichthys taakree</i> (Sykes)	...	1 specimen.
xxxiii.	<i>Silonopangasius childreni</i> (Sykes)	...	4 specimens.
xxxiv.	<i>Xenentodon cancila</i> (Ham.)	...	7 specimens.
xxxv.	<i>Ophicephalus marulius</i> Ham.	...	2 specimens.
xxxvi.	<i>Ambassis ranga</i> (Ham.)	...	12 specimens.
xxxvii.	<i>Glossogobius giuris</i> (Ham.)	...	13 specimens.

2. About one mile east of Fitzgerald bridge. 20-9-1936.

There is a rocky bed in this stretch which is about 80 yards wide and some 100 yards long. The average depth of the water is 4 to 5 feet and the current is more in the nature of a surface flow than one of a rushing current either centralised in midstream or against one of the banks. There are several islands which consist of basalt boulders standing up out of the water to a height of 15 to 20 feet.

i.	<i>Barbus (Puntius) Jerdoni</i> Day	...	2 specimens.
ii.	<i>Barbus (Puntius) kolus</i> Sykes	...	1 specimen.
iii.	<i>Cirrhinia fulungee</i> (Sykes)	...	2 specimens.
iv.	<i>Crossochilus latius</i> (Ham.)	...	2 specimens.
v.	<i>Labeo fimbriata</i> (Bl.)	...	2 specimens.
vi.	<i>Labeo potail</i> (Sykes)	...	3 specimens.

3. Stretch about 2 miles east of Fitzgerald bridge. 29-11-1936.

The stretch is an extensive pocket about 40 by 50 yards connected with the main channel of the river. A section of the ground here is deeper than the bed adjoining and a collection of water in it has become landlocked. The average depth is 3 feet in the middle of it and in the shallows about 1 foot. It is partly rocky and silted up. In the silted sections algae are present and some weeds. There is no current. The water is dirty-looking with a scum on the surface.

i.	<i>Notopterus notopterus</i> (Pallas)	...	42 specimens.
ii.	<i>Mastacembelus armatus</i> (Lacép.)	...	7 specimens.
iii.	<i>Barbus (Puntius) chola</i> (Ham.)	...	3 specimens.
iv.	<i>Barbus (Puntius) ticto</i> Ham.	...	9 specimens.
v.	<i>Garra mulya</i> (Sykes)	...	1 specimen.
vi.	<i>Nemachilus botia</i> var. <i>aureus</i> Day	...	4 specimens.
vii.	<i>Nemachilus dayi</i> Hora	...	16 specimens.
viii.	<i>Mystus cavasius</i> (Ham.)	...	2 specimens.
ix.	<i>Ambassis ranga</i> (Ham.)	...	8 specimens.

4. A rocky pool, 3 miles east of Fitzgerald bridge. 6-12-1936, and 28-5-1937.

The pool is situated in a boulder strewn stretch and is nearly in the form of a square. It is practically all rock and so is its bed. There is a centrally running current of moderate intensity. Green algae are present in some portions of the pool where the current is weak, especially in its angles. The depth varies from 2 feet to over 6 feet centrally.

i.	<i>Notopterus notopterus</i> (Pallas)	...	8 specimens.
ii.	<i>Chela phulo</i> Ham.	...	1 specimen.
iii.	<i>Barilius barna</i> Ham.	...	1 specimen.
iv.	<i>Barbus (Puntius) Jerdoni</i> Day	...	3 specimens.

v.	<i>Barbus (Puntius) kolus</i> Sykes	...	1 specimen.
vi.	<i>Barbus (Puntius) sarana</i> (Ham.)	...	4 specimens.
vii.	<i>Barbus (Puntius) ticto</i> Ham.	...	5 specimens.
viii.	<i>Barbus (Tor) khudree</i> Sykes	...	5 specimens.
ix.	<i>Cirrhitina fulunjee</i> (Sykes)	...	1 specimen.
x.	<i>Garra mullya</i> (Sykes)	...	7 specimens.
xi.	<i>Labeo potail</i> (Sykes)	...	3 specimens.
xii.	<i>Mystus cavasius</i> (Ham.)	...	2 specimens.

5. A run about 3 miles below lake Fife. 20-12-1936.

This particular reach of the river is a broad expanse of water about 400 yards long and 80 yards broad. Here apparently the river has collected in a deep depression in the surface of the land, because above and below the section the river flows in very narrow channels barely 8 yards broad. The average depth midstream must be over 6 feet as the depth near the banks are 4 feet. The banks are roughly 3 feet above the water level. The direction of the river is due north-east and the banks lie roughly west and east. On the west bank and flanking it is a hill on which Babul, Tea, Tamarind and Mango flourish. The east bank is similarly wooded and the adjacent land is undulating. The banks are earthy here and so is the bed of the river, and the edges are grown with weeds and underwater vegetation. The river bed above and below the reach under reference is covered with small boulders and coarse sand. There is a moderate current which hugs the west bank and here the bed is silted. It was difficult working with a net on account of the weeds.

i.	<i>Danio aequipinnatus</i> (McClell.)	...	4 specimens.
ii.	<i>Rasbora daniconius</i> (Ham.)	...	5 specimens.
iii.	<i>Barbus (Puntius) kolus</i> Sykes	...	3 specimens.
iv.	<i>Barbus (Tor) khudree</i> Sykes	...	1 specimen.
v.	<i>Crossochilus latius</i> (Ham.)	...	2 specimens.
vi.	<i>Labeo calbasu</i> (Ham.)	...	5 specimens.
vii.	<i>Labeo potail</i> (Sykes)	...	1 specimen.
viii.	<i>Rohitee vigorsii</i> (Sykes)	...	2 specimens.
ix.	<i>Nemachilus dayi</i> Hora	...	2 specimens.
x.	<i>Ambassis ranga</i> (Ham.)	...	2 specimens.

6. Lake Fife (Kharkwasla). 20-12-1936.

The fishes were caught on the east beach which is shingle and rock, and they were taken near the dam which is about 35 feet high. There is a current created here due to the flow of water through the sluices into the right bank canal. The bank slopes to the water's edge and for a yard length is about a foot in depth. It then deepens suddenly to 5 feet and thereafter it must be very deep. I do not know the exact depth of the lake in its deepest portions, but in casting a net from the boat and letting out the drag rope to the fullest extent the weighted end of the net did not touch bottom. Towards the Boat Club enclosure the water does not deepen suddenly. The maximum level of the water as shown on the map is during September 1911 feet and the minimum 1883 feet in June. The lake is fed by the Mutha and Mose rivers and the greater volume of its water is diverted into the right and left bank canals. The left bank canal ends 'near Kirkee.

i.	<i>Chela boopis</i> Day	...	2 specimens.
ii.	<i>Danio aequipinnatus</i> (McClell.)	...	4 specimens.
iii.	<i>Barbus (Puntius) kolus</i> Sykes	...	1 specimen.
iv.	<i>Barbus (Puntius) sarana</i> (Ham.)	...	1 specimen.
v.	<i>Barbus (Tor) khudree</i> Sykes	...	1 specimen.
vi.	<i>Cirrhitina fulunjee</i> (Sykes)	...	1 specimen.
vii.	<i>Garra mullya</i> (Sykes)	...	3 specimens.
viii.	<i>Glossogobius giuris</i> (Ham.)	...	18 specimens.

7. The stretch of the Mutha-Mula river near the Infectious Hospital, Poona. 24-12-1936.

At the time of the visit this section was covered with a green scum of algae, and there was no surface flow or evidence of any current. The stretch

is about 40 yards wide and 400 yards long. In actual fact the continuity of the river here is divided into two streams by a large island. The stretch under reference is the one which runs by the island on its eastern side as the direction of the river is north-east. The island is large and is as long as the run itself and as broad. It is grown with Babul, Mango, Tamarind and Pipal trees and is cultivated. The average depth of the run must be at least 4 feet. Near the banks it is 1-2 feet and is mostly earthy composed of an earthy bed covered with silt. In parts of the bed there is evidence of some rock. The bank on the hospital side is heavily wooded with Babul.

i. <i>Notopterus notopterus</i> (Pallas)	...	2 specimens.
ii. <i>Barbus</i> (<i>Puntius</i>) <i>Jerdoni</i> Day	...	1 specimen.
iii. <i>Barbus</i> (<i>Puntius</i>) <i>ticto</i> Ham.	...	100 specimens.
iv. <i>Barbus</i> (<i>Tor</i>) <i>khudree</i> Sykes	...	17 specimens.
v. <i>Garra mullya</i> (Sykes)	...	67 specimens.
vi. <i>Nemachilus dayi</i> Hora	...	19 specimens.
vii. <i>Mystus cavasius</i> (Ham.)	...	36 specimens.
viii. <i>Rita pavimentata</i> (Val.)	...	1 specimen.

8. Mutha-Mula river near Kharadigaon village. 27-12-1936, 16-1-1937 and 10-6-1937.

The river in this section is a long run of a mile or more flowing due east. The north bank is rocky, and the force of the current which is moderately strong is directed against the north bank. There is no vegetation on this side. The south bank is a shingled beach, and nearer the water's edge is pebbled. The bed of the river is rock partly, and the greater portion is pebbled. The depth in its deepest parts nearer the north bank must be over 6 feet. It is more shallow—about 2 feet—near the south bank. The width of the expanse is roughly 90 yards across. The south bank is wooded with Babul. On the last visit (10-6-1937) the volume of water in this section had greatly decreased, and the current was very sluggish. The width of the run is now about 50 yards, and there is a large amount of algae at the sides of the river. The beach, from which the water has receded, is now dry and shows a large amount of silt admixed with sand in which are numerous empty shells of univalve and bivalve molluscs.

i. <i>Notopterus notopterus</i> (Pallas)	...	2 specimens.
ii. <i>Chela clupeoides</i> (Bl.)	...	38 specimens.
iii. <i>Danio aequipinnatus</i> (McClell.)	...	5 specimens.
iv. <i>Rasbora daniconius</i> (Ham.)	...	9 specimens.
v. <i>Barbus</i> (<i>Puntius</i>) <i>amphibius</i> (C.V.)	...	5 specimens.
vi. <i>Barbus</i> (<i>Puntius</i>) <i>kolus</i> Sykes	...	1 specimen.
vii. <i>Barbus</i> (<i>Puntius</i>) <i>sarana</i> (Ham.)	...	1 specimen.
viii. <i>Barbus</i> (<i>Puntius</i>) <i>ticto</i> Ham.	...	9 specimens.
ix. <i>Barbus</i> (<i>Tor</i>) <i>khudree</i> Sykes	...	4 specimens.
x. <i>Cirrhitina fulungee</i> (Sykes)	...	4 specimens.
xi. <i>Garra mullya</i> (Sykes)	...	15 specimens.
xii. <i>Labeo potail</i> (Sykes)	...	5 specimens.
xiii. <i>Rohitee cotio</i> var. <i>cumma</i> Day	...	2 specimens.
xiv. <i>Rohitee vigorsii</i> Sykes	...	7 specimens.
xv. <i>Schizothoracichthys</i> (<i>Nukta</i>) <i>nukta</i> (Sykes)	...	1 specimen.
xvi. <i>Callichthys pabo</i> Ham.	...	1 specimen.
xvii. <i>Rita pavimentata</i> (Val.)	...	1 specimen.
xviii. <i>Glyptothorax conirostre</i> var. <i>poonaensis</i> Hora	...	1 specimen.
xix. <i>Ophicephalus marulius</i> Ham.	...	3 specimens.
xx. <i>Glossogobius giuris</i> (Ham.)	...	3 specimens.

9. Lake Pashan. 3-1-1937.

Lake Pashan is shaped like the segment of a circle, roughly half a mile long and a quarter of a mile broad, and is really a catchment in which mostly rain drainage during the monsoon collects. There are a few narrow streams, more in the nature of rivulets and fed by springs, draining into the

lake on its western side. Lake Pashan is the water supply for Government House at Ganeshkind. There is a filtration plant and reservoir on the side near the bunded portion on its northern face. The bund is an earthy bank which has been built upon with stone masonry and extends for about 400 yards. Part of the southern boundary of the lake consists of a dam about 10 feet above the water's surface, and about 100 yards long. The rest of the bank is earthy on a rocky base except in parts where it is altogether earthy, and a fringe of about 300 yards on the southern side and another similar length on its western aspect are rankly grown with under-water weeds. The bed of the lake is in the greater part rocky and sanded. The western side is fairly well wooded with Mango and Babul, and where the streams join the lake it is marshy and grown with weeds and rushes. The banks here are turfed. In the marshy section there are numbers of aquatic birds of various kinds including duck. It was from this portion that most of the fishes were secured. The small streams—three in number—mentioned above had no fishes in them. This may be due to the presence of aquatic birds in the locality. The streams are about 100 yards in extent and run down from hillocks which are about 100 feet above the level of the lake, and their sources had no pools but the water oozed through rocky strata in the hill-side. Owing to the great depths in parts of the lake which has an average depth of 18 feet, it was impracticable to use a net, and although I was given the use of a boat and made every effort to have the bell-shaped casting net thrown over and over again in the middle of the lake, the results were very poor indeed.

i. <i>Notopterus notopterus</i> (Pallas)	... 1 specimen.
ii. <i>Chela boopis</i> Day	... 30 specimens.
iii. <i>Danio aequipinnatus</i> (McClell.)	... 38 specimens.
iv. <i>Rasbora daniconius</i> (Ham.)	... 73 specimens.
v. <i>Barbus (Puntius) amphibius</i> (C.V.)	... 4 specimens.
vi. <i>Barbus (Puntius) kolus</i> Sykes	... 1 specimen.
vii. <i>Barbus (Puntius) ticto</i> Ham.	... 40 specimens.
viii. <i>Cirrhitina fulungee</i> Sykes	... 37 specimens.
ix. <i>Crossochilus latius</i> (Ham.)	... 2 specimens.
x. <i>Garra mullya</i> (Sykes)	... 1 specimen.
xi. <i>Nemachilus botia</i> var. <i>aureus</i> Day	... 3 specimens.
xii. <i>Nemachilus dayi</i> Hora	... 1 specimen.

10. Mula river near the Ice Factory, Kirkee. 24-I-1937.

On the main road to Kirkee after leaving Government House on the left of the Railway line and half way between it and Kirkee there is an ice factory located on the west bank of the Mula river. The stretch explored here is a broad expanse roughly 150 yards in width. A ferry service works here, and numerous contractor's rafts ply between the banks carrying sand. The direction of the flow is from north to south and the banks therefore lie east and west respectively. The east bank is sparsely grown with trees and other vegetation, and there are a number of workmen engaged in digging operations removing sand from the small hillocks on it. The west bank is more wooded and the part near the water's edge is well turfed. The east bank has a beach of coarse sand and more inland are the sandy hillocks which rise to about 30 feet above the water's surface. The west bank is 10 to 15 feet above the water and the ground here is earthy. There is a strong central current, and midstream the depth must be at least 12 feet while near the water's edge it is 3-4 feet. The bed near the bank is sanded and silted in parts. Nearly all of the larger fishes in this batch were caught between the bank and midstream. The fish called Ambli [*Chela phulo* Ham] and all of the smaller fry including especially Chandwah [*Ambassis ranga* (Ham.)] were netted from a boat in midstream. Chandwah and Chalut [*Notopterus notopterus* (Pallas)] are the dominant species.

i. <i>Notopterus notopterus</i> (Pallas)	... 18 specimens.
ii. <i>Mastacembelus armatus</i> (Lacép.)	... 1 specimen.
iii. <i>Chela phulo</i> Ham.	... 38 specimens.
iv. <i>Danio aequipinnatus</i> (McClell.)	... 5 specimens.
v. <i>Rasbora daniconius</i> (Ham.)	... 1 specimen.
vi. <i>Barbus (Puntius) chola</i> (Ham.)	... 3 specimens.
vii. <i>Barbus (Puntius) kolus</i> Sykes	... 2 specimens.

viii.	<i>Barbus (Puntius) sarana</i> (Ham.)	...	5 specimens.
ix.	<i>Barbus (Puntius) tigto</i> Ham.	...	4 specimens.
x.	<i>Callichrons pabo</i> Ham.	...	2 specimens.
xi.	<i>Mystus Deenghala</i> (Sykes)	...	5 specimens.
xii.	<i>Mystus cavasius</i> (Ham.)	...	1 specimen.
xiii.	<i>Xenentodon cancila</i> (Ham.)	...	1 specimen.
xiv.	<i>Ambassis ranga</i> (Ham.)	...	321 specimens.

11. Junction of the Mutha with the Mula river, called the Sangam. 7-2-1937.

About 80 yards below Wellesly bridge the Mutha river meets the Mula and this junction is known as the Sangam. There is a very large expanse of water here. The direction of the Mutha river is due north. The Mula river after flowing south, is deflected westwards a little above the junction with the Mutha, and from this point the waters of the combined rivers flow in a north-easterly direction. On the east bank at the junction there is a temple and the stretch below this temple on the same bank was explored. There are crowds of people here washing and bathing around and in the temple precincts. The bank is earthy and sloping and parts of it are turfed. The opposite bank is about 10 feet above the water, it is well turfed and sparsely wooded. Between the banks a ferry service operates. There is a strong central current and the depth midstream must be well over 15 feet. The bank which was explored is from 2-6 feet in depth and the bed is silted over an earthy base. Peelah Powwul [*Chela phulo* Ham.] and Deotee [*Rohtee cotio* var. *cunma* Day] appear to be the dominant species in this locality.

i.	<i>Notopterus notopterus</i> (Pallas)	...	3 specimens.
ii.	<i>Chela phulo</i> Ham.	...	24 specimens.
iii.	<i>Rasbora daniconius</i> (Ham.)	...	1 specimen.
iv.	<i>Barbus (Puntius) kolus</i> Sykes	...	4 specimens.
v.	<i>Barbus (Puntius) sarana</i> (Ham.)	...	2 specimens.
vi.	<i>Cirrhhina fulungee</i> Sykes	...	1 specimen.
vii.	<i>Rohtee cotio</i> var. <i>cunma</i> Day	...	29 specimens.
viii.	<i>Rohtee vigorsii</i> Sykes	...	19 specimens.
ix.	<i>Callichrons bimaculatus</i> (Bl.)	...	2 specimens.
x.	<i>Mystus gulio</i> (Ham.)	...	1 specimen.
xi.	<i>Xenentodon cancila</i> (Ham.)	...	2 specimens.
xii.	<i>Ambassis ranga</i> (Ham.)	...	3 specimens.

12. Right bank canal, below the Empress Gardens. 14-2-1937, 6-3-1937, 4-4-1937, and 1-6-1937.

The right bank irrigation canal conducts the waters from lake Fife and runs in an irregular way meandering through Poona, and by a rocky subterranean channel under the race course, reaches the Empress Gardens. From thence it flows south of and almost parallel with the Mutha-Mula river for many miles until it finally terminates at a point about a mile or more south of a village called Nangaon on the Bhim river. In the direct route it is roughly 60 odd miles, but actually is probably 100 miles long. The section explored is the run between the Empress Gardens and the M. S. M. Railway crossing and from thence to the Hardapsar road bridge a total of about $4\frac{1}{2}$ miles. In parts of this stretch the bed is rock and sand and in other sections it is silted over and rankly grown with weeds. The banks stand 15 feet above the water and for the canal's whole length in this section there are broad footpaths on both banks. On both sides of these footpaths the banks are heavily wooded. Those trees on the near side of the water consist chiefly of Date Palms, interspersed with Babul and Pipal, and the branches of some of the latter trees overhang the water to the extent that they nearly touch the water's surface. The off side of each bank is much more wooded and the Mango tree here predominates. About half way in this stretch there is a small village standing 50 yards away from the bank. Its population numbers some 100 persons who use the water for all purposes. The average depth is roughly 4 feet, but in parts it is 8 feet and there is always a large volume of water flowing through it with a very strong current at all times, except for 3 days in the year—2nd to 4th June—when the water is shut off at lake Fife to allow of the channel

being cleared of weeds. The canal is then in the higher parts quite dry, but there are long stretches in its deeper section which contain at least 18 inches of water and the fishes do not suffer very much. The fishes in the batch which have been recovered from the canal should in a fair way represent the range of species which share a preference for strong currents.

i.	<i>Chela clupeoides</i> (Bl.)	...	14 specimens.
ii.	<i>Chela phulo</i> Ham.	...	28 specimens.
iii.	<i>Danio aequipinnatus</i> (McClell.)	...	136 specimens.
iv.	<i>Rasbora daniconius</i> (Ham.)	...	47 specimens.
v.	<i>Barbus (Puntius) amphibius</i> (C.V.)	...	34 specimens.
vi.	<i>Barbus (Puntius) chola</i> (Ham.)	...	11 specimens.
vii.	<i>Barbus (Puntius) jerdoni</i> Day	...	1 specimen.
viii.	<i>Barbus (Puntius) sarana</i> (Ham.)	...	16 specimens.
ix.	<i>Barbus (Puntius) ticto</i> Ham.	...	54 specimens.
x.	<i>Cirrhitina fulungee</i> Sykes	...	2 specimens.
xi.	<i>Crossochilus latius</i> (Ham.)	...	22 specimens.
xii.	<i>Garra mullya</i> (Sykes)	...	13 specimens.
xiii.	<i>Labeo boggut</i> (Sykes)	...	5 specimens.
xiv.	<i>Rohtee cotio</i> var. <i>cunma</i> Day	...	2 specimens.
xv.	<i>Rohtee vigorsii</i> Sykes	...	1 specimen.
xvi.	<i>Lepidocephalus guntea</i> (Ham.)	...	1 specimen.
xvii.	<i>Nemachilus botia</i> var. <i>aureus</i> Day	...	3 specimens.
xviii.	<i>Nemachilus dayi</i> Hora	...	1 specimen.
xix.	<i>Callichtrons bimaculatus</i> (Bl.)	...	3 specimens.
xx.	<i>Mystus cavasius</i> (Ham.)	...	4 specimens.
xxi.	<i>Aplochilus lineatus</i> (C.V.)	...	1 specimen.
xxii.	<i>Xenentodon cancila</i> (Ham.)	...	7 specimens.
xxiii.	<i>Ambassis ranga</i> (Ham.)	...	11 specimens.
xxiv.	<i>Glossogobius giuris</i> (Ham.)	...	10 specimens.

13. Stretch of the Mula river near to the Central Mental Hospital, Yeravda. 21-2-1937 and 24-2-1937.

The fishes were taken from the stretch of about a furlong length which runs by the Central Mental Hospital, Yeravda. The Mula river here flows in a fairly straight course from north to south and the banks therefore lie east and west. There is a broad expanse of water here about 50 yards across, and there is a sluggish current which bears directly against the west bank which is practically bare of vegetation and consists of rocky plinths sloping to the water's edge with large boulders interspersed here and there. The east bank on which lie the vegetable and fruit producing lands controlled by the authorities of the Central Mental Hospital, Yeravda, is entirely earthy, but nearer the water's edge in certain parts there is evidence of a rocky foundation underlying. This bank is precipitous and stands about 30 feet above the water. The depth in this run would be at least 15 feet midstream. Near the bank it is 3 feet for about 5 yards and then suddenly deepens to over 8 feet. The bed appears to be rocky and silted over. The silted area is grown with weeds. There is evidence also that there is a strong undercurrent about midstream, where eddies are visible and in using a rod and line one's float is drawn down, but this happens only occasionally and objects such as leaves floating on the surface of the water are seen moving very slowly.

i.	<i>Notopterus notopterus</i> (Pallas)	...	2 specimens.
ii.	<i>Mastacembelus armatus</i> (Lacép.)	...	1 specimen.
iii.	<i>Chela boopis</i> Day	...	1 specimen.
iv.	<i>Barbus (Puntius) jerdoni</i> Day	...	1 specimen.
v.	<i>Barbus (Puntius) kolus</i> Sykes	...	2 specimens.
vi.	<i>Barbus (Puntius) sarana</i> (Ham.)	...	1 specimen.
vii.	<i>Barbus (Puntius) ticto</i> Ham.	...	19 specimens.
viii.	<i>Cirrhitina fulungee</i> Sykes	...	4 specimens.
ix.	<i>Garra mullya</i> (Sykes)	...	2 specimens.
x.	<i>Rohtee cotio</i> var. <i>cunma</i> Day	...	41 specimens.
xi.	<i>Ophicephalus marulius</i> Ham.	...	1 specimen.
xii.	<i>Ambassis ranga</i> (Ham.)	...	15 specimens.
xiii.	<i>Glossogobius giuris</i> (Ham.)	...	12 specimens.

14. Stretch of the Mula river east of Holkar bridge. 28-2-1937.

The fishes were taken from the stretch of about 400 yards east of Holkar bridge. The Mula river here flows in a practically straight course from east to west and the banks lie north and south respectively. There is a large expanse and volume of water with a strong midstream current and a flow of less intensity near the banks. The north bank is heavily wooded with Pinal, Mango, Tamarind, and Babul. Their branches, in parts, overhang and touch the water. At the water's edge there is a heavy growth of rushes and weeds. The south bank is less wooded and the trees are all Babul. This bank is turfed up to the water's edge where in the greater part of its length there is a thick growth of weeds. The base of the bank is practically all rock with an earthy layer overlying, and in the parts which are breached there are pockets of stagnant water 18 inches deep with much algae in evidence. The bed of the river on the south bank is practically all rock and the greater portion is silted over. The depth midstream must be well over 15 feet and near the south bank 3-4 feet. The width of the river is the length of the bridge which is 90 yards long and 35 feet above the water line.

i. <i>Notopterus notopterus</i> (Pallas)	...	2 specimens.
ii. <i>Chela clupeoides</i> (Bl.)	...	3 specimens.
iii. <i>Chela phulo</i> (Ham.)	...	30 specimens.
iv. <i>Barbus (Puntius) amphibi</i> (C.V.)	...	1 specimen.
v. <i>Barbus (Puntius) kolus</i>	...	3 specimens.
vi. <i>Barbus (Puntius) sarana</i> (Ham.)	...	4 specimens.
vii. <i>Cirrhitina fulguree</i> (Sykes)	...	2 specimens.
viii. <i>Garra mullya</i> (Sykes)	...	2 specimens.
ix. <i>Labeo potail</i> (Sykes)	...	9 specimens.
x. <i>Rohitee cotio</i> var. <i>cunma</i> Day	...	10 specimens.
xi. <i>Rohitee vigorsii</i> Sykes	...	1 specimen.
xii. <i>Callichrons pabo</i> Ham.	...	1 specimen.
xiii. <i>Proeutropichthys taakree</i> (Sykes)	...	3 specimens.
xiv. <i>Xenentodon cancila</i> (Ham.)	...	7 specimens.

15. Section of the Mula river near Bopkhel. 14-3-1937.

In this section the Mula river runs in a loop. The reach explored is the portion of this loop which flows due east. The width here is about 60 yards, and there is a fair volume of water with a central current which is moderately strong. The depth at the sides is 3-4 feet and centrally it is at least 10 feet. The surrounding country is bare of vegetation except for a few Babul trees. The banks are rocky and slope to the water's edge and are 20 feet above the water. The surface of both banks shows strata of shingle and the adjacent land is in the nature of shingle with rock showing here and there and covered with a thin earthy layer which is turfed. The bed of the river is rock and sand and parts of it are silted.

i. <i>Chela phulo</i> Ham.	...	2 specimens.
ii. <i>Barbus (Puntius) jerdoni</i> Day	...	1 specimen.
iii. <i>Barbus (Puntius) kolus</i> Sykes	...	2 specimens.
iv. <i>Barbus (Puntius) sarana</i> (Ham.)	...	4 specimens.
v. <i>Labeo boggut</i> (Sykes)	...	1 specimen.
vi. <i>Rohitee cotio</i> var. <i>cunma</i> Day	...	1 specimen.
vii. <i>Ambassis ranga</i> (Ham.)	...	1 specimen.

16. Tanks (catchment areas) at Katraj village. 21-3-1937.

There are two tanks here near to the village of Katraj which has a population of about 2,000 inhabitants. The majority of this number are low caste men called 'Mahars' and they use the water in the upper tank, which is nearer the village, for all purposes. The high caste section of the village use a well which is located on high ground between the upper and lower tanks. The upper one is higher, placed at a height of roughly 50 feet or more above the lower. There is a drainage channel between the two by which water, dependent upon the level of it in the upper, flows into the lower tank and the distance between them is one furlong and a half. The upper tank is one quarter

the size of the lower and both are catchments which fill up during the rains. There are no perennial streams feeding it and no springs. Both have dams of solid masonry. The upper dam is about 50 yards long and 8 feet broad and the lower is 200 yards long and 15 feet broad. The unfiltered water in the tanks is used by the Poona Suburban Municipality for watering roads. A pipe line from the lower tank conducts water for this purpose, presumably by gravity as there is no engine house in the near precincts. The upper tank is 50 yards long and 30 yards broad with a depth of 4 feet in its deepest part near the dam and 2 feet in the shallows. The lower tank is some 300 yards long and 200 yards broad with a depth of 6-8 feet in its deepest parts against the dam and 1-3 feet in the shallows. The height above sea level is roughly 2,440 feet. The singular peculiarity here is that the upper tank had all the fish in plenty. A few casts of the net brought in many. On the other hand although the larger tank was systematically surveyed every 25 yards or so—each cast, and there were many—recovered on an average one fish per cast. Instead of fish the net enmeshed a giant species of aquatic beetle in such numbers as to constitute a nuisance. These beetles appear to be the cause for the absence of fish in the shallows near the margin of the tank. There was no boat available here to explore the deeper sections. The fisherman who was with me states the beetles kill the fish. In all probability the fishes have been driven into the middle of the tank in its deeper parts. About 30 wild duck were in the middle and a variety of other aquatic birds in the neighbourhood. Except in the section against the dam, the margins of the tank had a growth of weeds and much algae. The upper tank had a small amount of algae but no weeds. The banks of both tanks are earthy and turfed over, and the terrain is fairly well wooded with Babul and Mango and near the banks are some Babul trees.

i. <i>Rasbora daniconius</i> (Ham.)	... 130 specimens.
ii. <i>Garra mullya</i> (Sykes)	... 87 specimens.
iii. <i>Parapsilorhynchus tentaculatus</i> (Annan.)	... 1 specimen.
iv. <i>Lepidocephalus guntea</i> (Ham.)	... 4 specimens.

17. Section directly above the Bund. 2-5-1937.

The section above the bund shows a wide expanse of water and is the length of the bund—about 150 yards in extent. At the time of the visit there was no water falling over the bund except a small rush through an exit in the masonry construction near the bund garden end. The flow of the river is to the east and the part of it against the north bank was explored. This bank is practically all rock and slopes to the water's edge. There was a large collection of an aquatic plant (the duck weed, referred to above in the general description of the river) spread over the surface of the water for the whole extent of the bund and above it for a distance of about 50 yards. The water above this again was clear of the weed and it was here that the fishes were caught. The bed appears to be all rock and there was no evidence of any current. The depth was from 2-6 feet near the bank. Higher up and nearer the road to Kirkee there were some Pipal and Tamarind trees which are 50 feet above and 30 yards from the water's edge. In the shallow margin there were some weeds and algae, particularly in the portions where the rocky base is silted up.

i. <i>Barbus (Puntius) dobsoni</i> Day	... 2 specimens.
ii. <i>Barbus (Puntius) sarana</i> (Ham.)	... 4 specimens.
iii. <i>Cirrhitina fulungee</i> (Sykes)	... 5 specimens.
iv. <i>Ophicephalus leucopunctatus</i> Sykes	... 1 specimen.

18. Mutha river in the section above the bridge called Lakri Pool. 29-5-1937.

The section explored was the run near the concrete causeway connecting the east bank on which Poona City lies with the west bank by which the road to Piranghat, Paud, and Mulshi lake passes. The causeway is roughly 400 yards south from and above Lakri Pool. The flow of the river is slightly north-easterly and in this section it is divided into two streams one running by the east bank and the other by the west bank. This latter stream has the

lesser volume of water. Directly above the causeway both streams unite to form a large collection of water in the depression which here exists, and the fishes in this batch were secured here. Except for a surface flow which is very sluggish against both the banks there is no current and the water is stagnant and foul smelling. Drovers of cattle are driven into this pool to wallow about in it. Crowds of people also bathe and wash clothes here. Below the causeway and extending up to Lakri Pool between the two streams is a pebbled beach. Above the causeway the collection of water, which is about 100 yards long and 130 yards broad, there is a similar pebbled stretch between the two streams. The width between the two banks proper is some 150 yards and the banks are earthy and slope down to the water from a height of about 30-40 feet. The depth in this pool is from 2 feet in the shallows to 5 feet in its deepest portions. The bed is earthy and silted over and in parts grown with weeds and algae. Directly where the two streams merge to form the pool the bed is sanded and silted. There is a large amount of mud in suspension as a result of cattle being driven into this pool. The flow in the streams is very sluggish.

i. <i>Chela boopis</i> Day	... 12 specimens.
ii. <i>Chela phulo</i> (Ham.)	... 1 specimen.
iii. <i>Barbus</i> (<i>Puntius</i>) <i>kolus</i> Sykes	... 5 specimens.
iv. <i>Cirrhitina fulungee</i> (Sykes)	... 5 specimen.
v. <i>Garra mullwa</i> (Sykes)	... 3 specimens.
vi. <i>Nemachilichthys ruppelli</i> (Sykes)	... 7 specimen.
vii. <i>Nemachilus botia</i> var. <i>aureus</i> Day	... 57 specimens.
viii. <i>Nemachilus dayi</i> Hora	... 3 specimens.
ix. <i>Ophicephalus gachua</i> Ham.	... 1 specimen.

19. A stagnant pool on the south bank of the Mutha-Mula river.
28-6-1937.

The pool is stagnant and very foul with evidence of sulphuretted hydrogen emanations. There is a heavy scum on the greater portion of its surface with fragments of floating algae. This collection of water is due to an ooze through the rocky strata of which it is mainly composed. There are large boulders flanking one side and also in the near precincts, and some portions of the bank and bed at the edges of the pool have an earthy deposit which is overgrown with long grasses and weeds. The bed is practically rocky throughout and grown with algae. The average depth is 18 inches and not more than 2 feet in its deepest parts. It is circular in shape with a diameter of 5 yards. The water is turbid, ashen in colour and foul smelling. The overflow is carried through a narrow channel (2 feet wide) which drains directly into the river. The pool is located on high ground near the south bank of the Mutha-Mula river between it and a sewage plant roughly about $2\frac{1}{2}$ miles east of Fitzgerald bridge. The fish called Konkani Garah [*Aplochilus lineatus* (C. V.)] is the only species in the pool. The single specimen of a baby Murrel [*Ophicephalus gachua* Ham.] in this batch was secured in the river end of the channel connecting the pool with the river.

i. <i>Aplochilus lineatus</i> (C. V.)	... 10 specimens.
ii. <i>Ophicephalus gachua</i> . Ham.	... 1 specimen.

ACKNOWLEDGEMENTS

I am greatly indebted to Dr. S. L. Hora and Mr. K. S. Misra of the Zoological Survey of India for the identifications of the species in this series, and to Mr. S. H. Prater, Curator of the Bombay Natural History Society Museum, for having given me the opportunity for carrying out the survey.

A CONTRIBUTION TO THE STUDY OF THE BIOLOGY AND PHYSIOLOGICAL ANATOMY OF INDIAN MARSH AND AQUATIC PLANTS.

PART II.

BY

J. F. R. D'ALMEIDA, B.A., M.SC.

St. Xavier's College, Bombay.

(With three plates).

(Continued from p. 304 of Vol. xlii, No. 2).

ELATINACEAE.

The *Elatinaceae* is a very small family containing only about 40 species in 2 genera, viz. *Elatine* and *Bergia*, widely distributed through the tropical and temperate regions of both hemispheres. They are generally small annual herbs for the most part living in water or on mud, with creeping stems rooting at the nodes and simple, opposite or whorled leaves with interpetiolar stipules. We owe our information regarding the anatomy of this family chiefly to the statements of Neidenzu (10).

KEY TO THE GENERA.

A. Sepals obtuse, aquatic herbs..... 1 *Elatine*.

B. Sepals acute, fls. 5-merous..... 2 *Bergia*.

The genus *Elatine* comprising 15 species of minute, glabrous aquatic or marsh annuals is spread over the northern hemisphere in the New as well as the Old World. Several of its species are amphibious and have been found to possess both land and water forms (6). Its best known members are the two British species *E. hexandra* DC. and *E. Hydropiper* Linn. (Water-pepper or Pipewort) which occur in Britain and Ireland and are scattered, though sparsely, over a wide range in Europe and North Asia. But what appears to be the most completely adapted plant of this family for aquatic life is *E. Alsinastrum* Linn., the whorled Waterwort of Europe and North Africa, which in addition to the characteristic air-passages and other aquatic features displays a well marked heterophylly described by Kerner (8) as follows: 'The aerial leaves are grouped in whorls of three. They have an ovate shape, and their margins are finely notched. Each is traversed by 3-5 veins. The leaves developed under water are divided almost their whole length into 3-4 narrow linear segments, and each whorl looks as if it were composed of twelve leaves. Each segment is smooth round the edge and traversed only by one central vein.' Two Indian species of *Elatine* have been recorded, viz. *E. americana* Arn. found in the Nilgiris and spread over New Zealand and Australia, and *E. ambigua* Wight occurring in the Western Peninsula and also in the Fiji Islands. They are insignificant and little known.

Three Indian species of *Bergia* are known, viz. *B. odorata* Edgew., *B. ammannioides* Roxb. and *B. capensis* Linn. Of these the latter two species are described in the Floras as aquatic or semiaquatic and are actually recorded from such habitats. *B. odorata*, on the other hand has no definite aquatic localities against it and is regarded as a terrestrial plant. Saxton (14) however mentions it in his *synsium* of Marsh plants, but adds that it also appears as a xerophytic type on land which is not swampy. Sabnis (5, 13) has described the anatomy of *B. odorata* and *B. ammannioides*, in both of which he has found a typical xerophytic structure indicating that he was dealing with plants taken from dry habitats.

It would appear from these conflicting accounts that both *B. odorata* and *B. ammannioides* are terrestrial plants that are capable, on occasion, of living under marsh or aquatic conditions. *B. capensis*, on the other hand, is a habitual marsh plant, and though it has not attained the marked specialization recorded for *Elatine Alsinastrum*, it possesses certain features in its external and internal morphology which are unmistakably adaptations to an

aquatic mode of life. In the light of what has been said above in regard to the habitats of the species of *Bergia* the following key to the Indian species will be found to be more correct than the conventional one given in the Floras:—

KEY TO THE INDIAN SPECIES.

- A. Plants usually terrestrial woody.
 - a. Stamens 10..... *B. odorata*.
 - b. Stamens 5..... *B. ammannioides*.
- B. Plants usually aquatic, succulent,
 - Stamens 10..... *B. capensis*.

Since *Bergia capensis* Linn. is the only Indian species definitely aquatic and is pretty common in India we take it for special study.

SYNONYMY.

Bergia capensis Linn. Mantiss. (1771), 241.

= *B. aquatica* Roxb.

= *B. verticillata* Willd.

= *Elatine verticillata* W. & A.

The plant grows on the margins of tanks and in ricefields. It is found in Bombay, Salsette, and in the Konkan and Deccan. It occurs also in other parts of India, and is distributed to Ceylon, Rangoon, Tropical Africa and Egypt. It usually lives partially submerged in water and also on mud in the rains, and scarcely survives the monsoon, dying, after seeding, almost as soon as the ground on which it lives becomes dried up. It is an annual glabrous succulent herb 15-30 cm. high, with branches decumbent or ascending. The stem and branches are pink, translucent, making visible, through the surface, the narrow central cylinder and the radially arranged partitions of the cortical air-spaces which make the stem appear ribbed. The leaves, even those which happen to be submerged, show no special aquatic features. They are ill-adapted for life under water and decay on submergence. They are 2.6-4 cm. by .7-1 cm., simple, opposite, elliptic-lanceolate, serrate, glabrous with short petioles and triangular-acute caducous stipules. The flowers are minute and occur in sessile or subsessile axillary clusters. The primary root is short-lived. It is soon replaced by a system of adventitious roots coming off from the lower nodes. In plants that grow partially or completely submerged, the roots show a differentiation into two kinds, viz. ground roots or mud roots (Figs. 1 and 2, *M*) and water roots (Figs. 1 and 2, *W*). The ground roots, i.e. those buried in the mud, are stout and white and they bear few slender threadlike branches. Root-hairs are present on the mud roots and are not confined as in most ordinary roots, to a small region above the root tip, but are spread all over the main roots and branches. The water roots, i.e. those which come off from the submerged nodes and float freely in the water, are thinner, more profusely branched, feathery in appearance, devoid of root-hairs and frequently green, simulating both in form and function the adventitious floating roots (2), the so-called 'pectinate organs' of *Trapa* (4). It may be mentioned that a differentiation of roots somewhat similar to those just described for *Bergia capensis* has been observed also in other water plants (1,7,11).

The anatomy of the plant is in conformity with its semi-aquatic mode of life. The transverse section of the stem (Fig. 3) closely resembles the figure given by Schenck (15) for the transverse section of the stem of *Elatine Alsinastrum*. The epidermis (Fig. 3, *Ep*, Figs. 5 and 6) consists of tubular cells elongated in the direction of the length of the axis and with the outer walls somewhat thickened in the subaerial parts. Chloroplasts are present in the epidermal cells of the submerged parts. Stomata are absent. Beneath the epidermis is a hypodermis (*Hyp*) of 4-5 layers of compactly arranged parenchymatous elements. The cortex is traversed by wide vertical air-passages or lacunae (*Lac*) separated from one another by single-layered radially arranged parenchymatous plates or partitions (*RP*) whose cells show a tendency for radial elongation the more so in the submerged portions of the stem (Fig. 4). The partitions are compactly built up and, viewed from the side (Fig. 7),

show no lateral outlets in the shape of intercellular spaces connecting adjoining lacunae, an arrangement calculated, it would appear, to effect an expeditious passage of air to the underground parts. The cortex on the inner side of the lacunae is only about 2 or 3 layers thick including the endodermis (End in Figs. 3 and 9) which latter in transverse section can be recognized as a band of thinwalled barrel-shaped cells. Chloroplasts are present in the cortical cells and are in greater abundance in the cells lining the cortical air-spaces. A pink pigment (anthocyanin) may be present in the cells of the epidermis and also in the innermost layers (including the endodermis). The cortical passages, however, are interrupted at the nodes by many-layered diaphragms which have intercellular spaces at the angles of the cells (Fig. 8) facilitating vertical communication between superposed air-passages. These nodal diaphragms are crowded with conglomerate crystals and contain abundant chloroplasts. Unlike *B. ammannioides* and *B. odorata* a sclerenchymatous pericycle is absent and the wood vessels are scarcely, if at all, lignified. In transverse section (Fig. 4) the wood vessels are seen to be arranged in radial rows separated by rays of parenchymatous cells extending to the pith. The pith is parenchymatous with intercellular spaces. Chloroplasts are present in the pith, especially in the neighbourhood of the xylem, and in the medullary rays.

The leaves show a mesophytic structure which, as the plant grows usually in saturated soil or in shallow water, grades towards the aquatic type especially in regard to the development of air-spaces. In the lamina the upper and lower epidermis consists of tabular cells (Figs. 10 and 11) which in surface view (Figs. 12 and 13) have wavy outlines. The thickening and cutinization of the epidermal cell-walls varies with the conditions of moisture in which the plant is growing. It is slight in plants growing in water but increases appreciably under drier conditions. There are no chloroplasts in the epidermal cells. Stomata are found on both the upper and lower surfaces being more abundant on the lower side as will be seen by comparing Figs. 12 and 13 which are drawn to the same scale. The guard-cells are more or less level with the ordinary epidermal cells. The mesophyll is bifacial. The palisade tissue is relatively thinner than the spongy part. It is represented by short cells, packed with chloroplasts, arranged in 3-4 rows. Though disposed in palisade fashion the cells are not very compactly arranged allowing for a free communication with the exterior through the stomata. The spongy tissue is made up of isodiametric cells more or less oval, rounded, or irregular-shaped. They are more loosely arranged than the palisade cells and contain fewer chloroplasts. The vascular bundles of the leaf-blade are surrounded by sheaths of clear cells. They are poorly lignified and there is, except for the slight thickening of the outer epidermal walls when the plant grows under drier conditions, scarcely any mechanical tissue formed. In the mid-rib, however, there is some development of mechanical tissue (Figs. 14 and 15). Both the upper and lower epidermal cells have their walls considerably thickened especially on the outer side. Further, on the depressed upper side the usual mesophyll is replaced by mechanical tissue (*m* in Fig. 10) composed of thick-walled cells. A parenchymatous tissue of clear cells with large air-spaces (Fig. 10) makes up the greater part of the prominent underside of the mid-rib which also contains a strongly developed vascular strand occupying the centre (Fig. 10).

According to Solereder (19) the air-passages (which are found in the stem of *B. aquatica* Roxb. (= *B. capensis* Linn.) and in all species of *Elatine*) recur in the primary cortex of the root where they are traversed by radial filaments of parenchymatous cells. This description would be applicable only to the floating water roots of *B. capensis* for there is a marked difference in structure between these water roots and the ground roots buried in the mud. In the former (Fig. 16) beneath the superficial layer (*Ep*) composed of thinwalled tabular cells there is a hypoderma (*Hy ϕ*) of about 3 layers of parenchyma and inside this the cortical lacunae are seen, in transverse section, to be separated by radial filaments (*Rf*) composed of more or less rounded or oval cells. Chloroplasts are present in the cells of the cortex abutting on the lacunae. The stele is very narrow relatively to the diameter of the root. In the ground root also the stele is much reduced in width. In the transverse section of such a root (Fig. 17) the cortex is seen to be much wider. Beneath the superficial layer (*Ep*) is a hypoderma (*Hy ϕ*) of

two layers of parenchymatous cells. The rest of the cortex appears to be made up of radial filaments (RF) of mostly elongated cells. These filaments are separated from one another by wide radially running gaps or spaces. In longitudinal section (Figs. 18, 19, 20) these radial filaments or chains are seen to be connected with filaments lying above and below them by means of vertical arms of certain irregular shaped cells belonging to the filaments. These meet corresponding arms of similar cells composing the filaments that lie above and below. In this way successive tiers of filaments are connected vertically. Connection between an upper and lower tier may also be effected by the oblique direction of a whole radial filament or of one of the arms of the cells composing it. A connection between two adjacent filaments of the same tier may also be brought about by branching in the horizontal plane or simply by the oblique direction of a filament (Fig. 17). The result of all this branching and anastomosis is a complicated spongy structure which closely resembles the loose, air-containing tissue found by several observers (3, 9, 12, 16, 17, 18, 20) in plants growing in marshy situations and regarded as a secondary tissue developed from a phellogen, the so-called 'aerenchyma' of Schenck (16). Whether the spongy cortex of the root of *Bergia capensis* is really an aerenchyma in the true sense, i.e. a secondary air-containing tissue developed from a phellogen, is doubtful. The plant shows no secondary development of tissues in its other parts and there is no trace of a phellogen in the root. The presumption would therefore be in favour of regarding this tissue found in the ground roots as a primary cortex developed in loose fashion after the manner of an aerenchyma in response to the condition of diminished aeration in the water-logged mud. The differences in external and internal features observable between the water and the mud roots are clearly related to their respective conditions of life. The profuse branching of the water roots, by increasing the absorbing surface and establishing intimate contact with the surrounding medium, facilitates absorption. The presence of chloroplasts in these roots indicates that the roots are also photosynthetic in function, and the occurrence of the chloroplasts in the very cells that abut on the air-spaces of the cortex while facilitating gas interchange between these cells and the air-spaces, renders possible the much needed accumulation of oxygen given off in the process. The mud roots, on the other hand, in addition to their ordinary function of fixation and absorption, serve as reservoirs of air and thus help indirectly in respiration.

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EXPLANATION OF PLATES.

Bergia capensis Linn.

PLATE I.

Fig. 1.—A habit drawing of the plant growing partially submerged. W, water roots; M, mud roots.

Fig. 2.—Mud root (M) and water root (W) enlarged.

PLATE II.

Fig. 3.—T.S. of the stem (aerial portion) of a plant which had been growing in water. *Ep*, epidermis; *Hyp*, hypoderma; *Lac*, lacuna; *RP*, radial partition wall; *End*, endodermis; *Ph*, phloem; *Xy*, xylem; *P*, pith. (× 40).

Fig. 4.—Portion of the T.S. of the same stem as above (submerged portion) showing radial elongation of the cells composing the partition walls (*RP*). (× 40).

Fig. 5.—Epidermis of Stem (surface view). (× 120).

Fig. 6.—Epidermis of Stem in T.S. and one layer of hypoderma. (× 120).

Fig. 7.—Side view of a radial partition wall as seen in a l.s. of the stem. No intercellular are visible between the cells. (× 40).

Fig. 8.—T.S. of stem showing the nodal diaphragm tissue. (× 120).

Fig. 9.—T.S. of stem showing stelar region. *End*, endodermis; *Xy*, xylem; *P*, pith. (× 120).

PLATE III.

Fig. 10.—(a) T.S. (diagrammatic) of the leaf showing the disposition of the various tissues. *p*, palisade tissue; *s*, spongy tissue; *m*, mechanical tissue on upper side of midrib; *l*, lacunar tissue of clear cells on under side of midrib; *vb*, vascular bundle. (× 20).

(b) T.S. (diagrammatic) of the leaf nearer the base than above showing the air-spaces in the region of the midrib. (× 20).

Fig. 11.—T.S. of the leaf. (× 96).

Fig. 12.—Upper epidermis of the leaf (surface view). (× 96).

Fig. 13.—Lower epidermis of the leaf (surface view). (× 96).

Fig. 14.—T.S. of the leaf showing the midrib tissue on the upper side. (× 96).

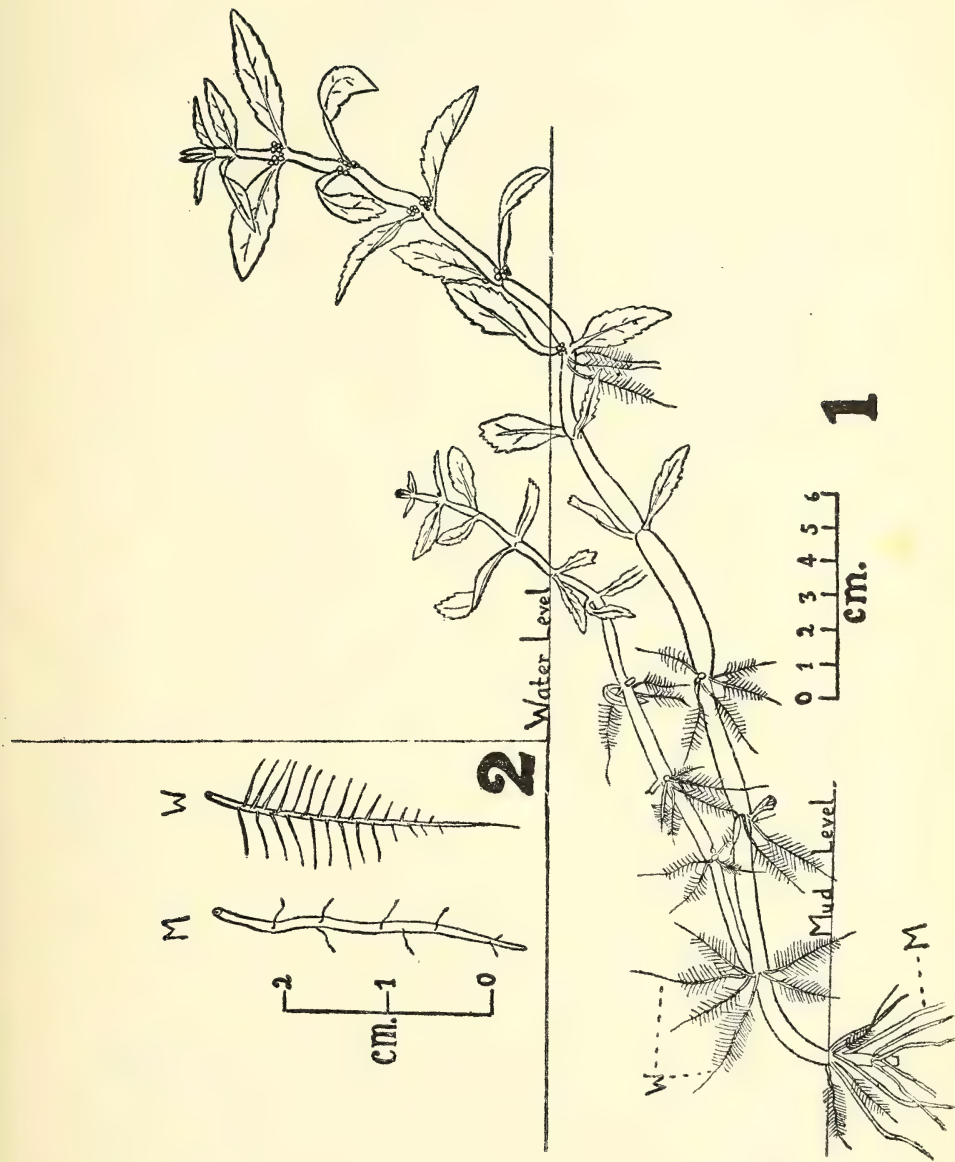
Fig. 15.—T.S. of the leaf showing the midrib tissue on the under side. (× 96).

Fig. 16.—T.S. of water root. *Ep*, epidermis; *Hyp*, hypoderma; *RF*, radial filaments; *End*, endodermis. (× 72).

Fig. 17.—T.S. of a mud root. Lettering as in Fig. 16. (× 72).

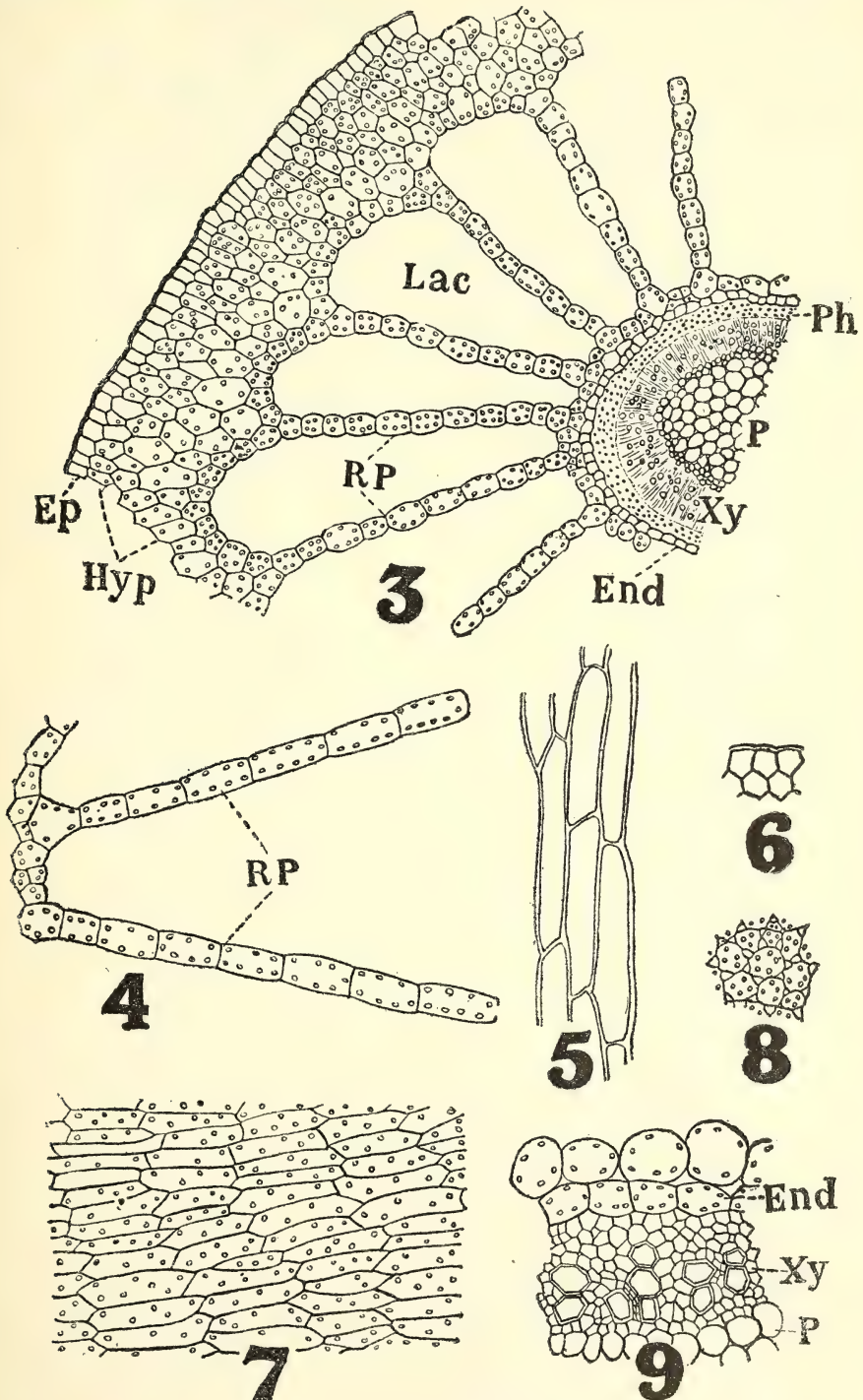
Figs. 18, 19 and 20.—Radial L.S. through mud root showing the various shapes of the cells composing the radial filaments, as well as the vertical connections between the successive tiers of filaments. (Fig. 18: × 48; Figs. 19 and 20: × 72).

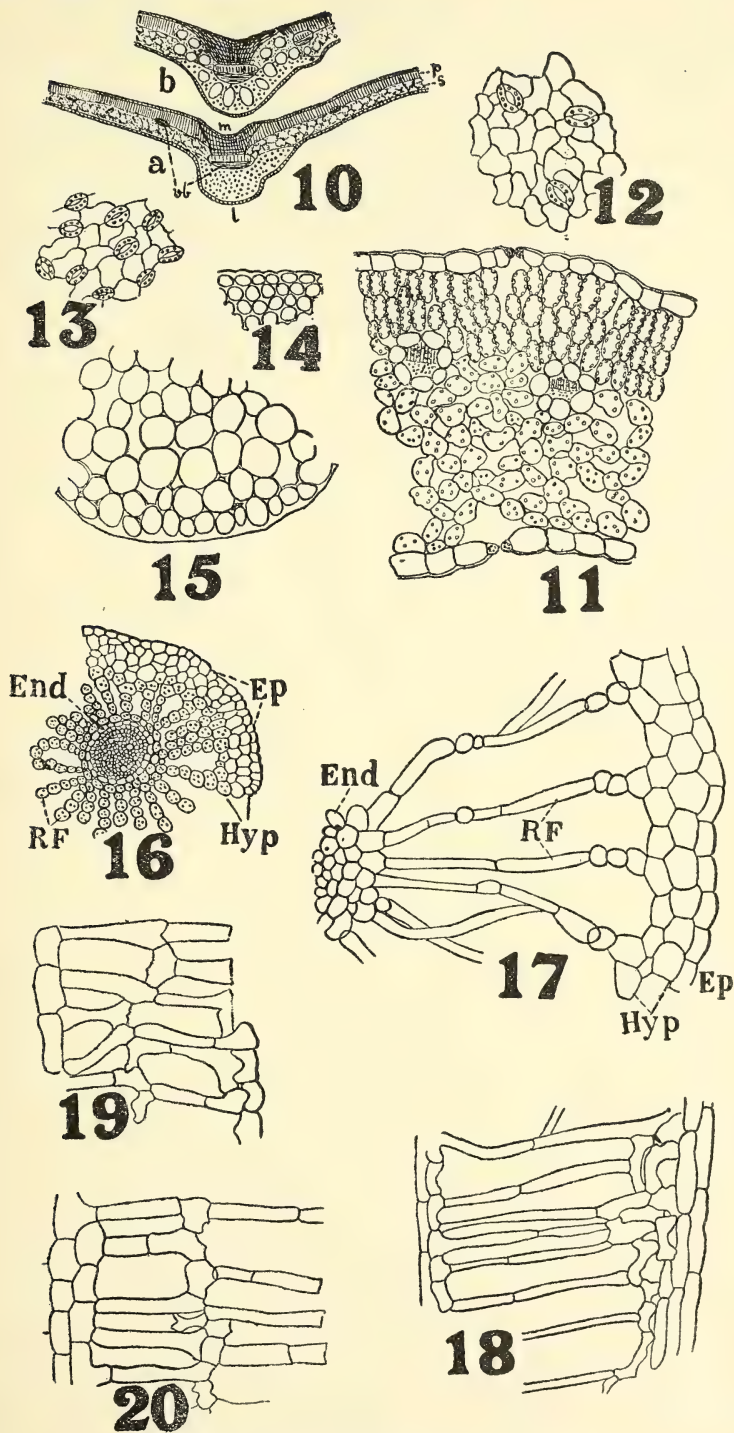
(To be continued).



D'Almeida—INDIAN MARSH AND AQUATIC PLANTS.

For explanation see end of article.





D'Almeida—INDIAN MARSH AND AQUATIC PLANTS.

For explanation see end of article.

REVIEWS

I.—SHELLS AND OTHER ANIMAL REMAINS FOUND ON THE MADRAS BEACH.—1. Groups other than Snails, etc. By F. H. Gravely (*Bull. Madras Govt. Museum* (n.s.), *Nat. Hist. Sect.* Vol. V, No. 1, pp. 1-112, figs. 1-30; December, 1941).

In India collectors of shells and Natural History objects in general are greatly handicapped for want of suitably illustrated handy volumes for identification of the material that is easily available, often in large quantities, on sandy beaches along the shores. Dr. Gravely has rendered a real service to the cause of Natural Science in general and to collectors of shells in particular by providing in the work under review a guide for the identification of the bivalves and animal remains, except for snails¹ etc., that are likely to be found 'on the sandy beaches of Madras and other places on the Coromandel and Golkonda Coasts, and even perhaps beyond'. The shells of molluscs form the majority of the animal remains washed up on sandy beaches, but other animals such as Protozoa, sponges, corals, jelly fish among Coelenterata, Ctenophora, Platyhelminths, Nemertine and segmented worms, Polyzoa, Brachiopods, Cephalopoda, Crustacea, Pycnogonida, Echinoderms and even some Chordates are also found, sometimes in large numbers. In this work Dr. Gravely has dealt with the commonly occurring forms of all these classes and provided short descriptive accounts, and excellent line drawings of representative species. In the case of hermit crabs and some edible crabs distinguishing characters of the commonly occurring genera and dichotomous keys for their identification are also published.

The main part of the work is devoted to the bivalve shells—mussels, shipworms, etc. (Lamellibranchiata or as they should more correctly be termed Pelecypoda). This part of the account is much more detailed than that dealing with other classes of animals. A simple but very useful dichotomous key of the various families is followed by brief accounts of the families, descriptions of the species and notes on their habitats. Figures usually of the right valve of a representative species of each genus are also published.

The account is based on the collections in the Madras Museum, fresh collections made by the author, and, last but not the least, the very rich collection of Mr. M. D. Crichton of Madras. All species definitely recorded from Madras are included, even though many of them are only found in the harbour or brought up by fishermen in nets and do not seem to get washed on to the sands. An interesting fact that has come to light is that many of the species which are marine at Krusadai Island near Pamban are exclusively estuarine at Madras. According to the author, this is probably due to the confinement of mud to the backwaters at Madras. As is, however, stated, further work is necessary to determine how far estuarine species are able to stand changes in salinity to which backwaters are subject, if they are to survive the changing conditions throughout the year.

In the descriptions and general accounts the author has tried as far as possible to replace scientific terms, which may not generally be intelligible, by more easily understood words, but this has not always been possible. For the same reason the names of the authors of the species and references to literature, synonymy, etc. are given at the end of the paper; this information would enable serious students to pursue the matter more easily. The detailed index of the names of genera and species adds to the value of the work.

Dr. Gravely's attempt to produce a semi-popular but scientifically accurate account of the animal remains of the Madras beach is very welcome, and it is hoped that it will be followed by similar works for other parts of the country and also for other groups of animals. Unless such works become available, the study of Natural History by amateurs is not likely to make much headway.

The work is well printed and the illustrations well reproduced. The price of Rs. 3-2-0 for a work of this type does not seem to be excessive.

B. P.

¹ The second part on snails is under preparation.

II.—THE ECOLOGY AND CONTROL OF THE FOREST INSECTS OF INDIA AND THE NEIGHBOURING COUNTRIES. By C. F. C. Beeson. Published by the author, printed at the Vasant Press, Dehra Dun, 1941. Pp. i-ii +1-1007, price Rs. 15.

The work under review is a veritable compendium of practically the whole field of our knowledge of the forest insects of economic importance in India. The fact that the author has been engaged in forest-entomological research in India during the last 30 years should ensure that the book is authoritative. The author also seems to be well posted with up-to-date literature. By a happy thought he has interspersed the text with apt and delightful quotations from that boon companion of our childhood, *Alice in the Wonderland*.

The book begins with an excellent chapter on the history of forest entomology in India. The early struggles to interest governmental heads in forest-entomological research are described, and also how they were finally successful. Nevertheless, they are of live interest to this day when one finds almost the same apathy. The growth of our knowledge of forest entomology in India may be judged from the fact that whereas in 1899 the life-histories of only about 100 forest insects were known, the present book deals with some 4,300 species, and this figure does not include all the species worked out.

Dr. Beeson estimates the total expenditure on the entomological branch of the Dehra Dun Institute during the last thirty years at rupees sixteen lakhs. A single major infestation in forests might cause damage equalling that figure. Entomological research conducted at the Institute has controlled at least one such infestation. Therefore, all the knowledge gained, the library and the insect collections that have been built up, and the numerous infestations controlled to-date can be regarded as a net profit available for financing future research. However, said Alice, 'I can't believe that'!

The rest of the book is divided into two parts. Part I (pp. 19-792), 'The Ecology of Forest Insects', deals with the ecology and life-history of nearly 4,300 insects affecting forests. In accordance with the author's peculiar alphabetical arrangement, the first order dealt with is Anoplura, the second Coleoptera, and so on. Under each order, the families are arranged alphabetically, and under each family the various species also follow a similar arrangement. For each species a list of the plants attacked is given, followed by a brief description of the life-history. The more important species are dealt with in considerable detail. At the end of each family, or in some cases, each species, a list of references is given. Thus, the references to literature are interspersed throughout the book.

Part II (pp. 793-990) deals with control measures. At first the general factors governing the abundance of insects are discussed in considerable detail, including factors both of natural control (e.g., climatic, nutritional and biotic) and artificial control (e.g., silvicultural, biological, mechanical and chemical). This is followed by the section on scientific control measures for the specific pests.

At the end there is a subject index. The illustrations are numerous and good.

The book suffers from certain defects for which both the author, as publisher, and the printers must share responsibility. To start with, there is no table of contents. Such a table would have been invaluable for reference purposes. The scattering of literature in a hundred and one places in the body of the book is an annoying practice and makes consultation difficult. The author might have listed the references at the end of each chapter, or, best of all, at the end of the book. While the illustrations are on the whole good, their utility is in several cases marred by an absence of margin, resulting in essential parts of the illustration being trimmed away. The arrangement of the insect orders and families alphabetically rather than in their natural sequence based on affinity is a grave defect. However, for the species within the family the alphabetical arrangement seems to serve a practical purpose. These are, however, minor defects in an otherwise sound book.

We can heartily commend this excellent book to all forest officers and entomologists. It provides an up-to-date textbook on forest entomology in India, and Dr. Beeson is to be congratulated on producing it at the low price of Rs. 15.

M. L. R.

MISCELLANEOUS NOTES

I.—AN HERMAPHRODITE TIGER.

I send you the few details available of an hermaphrodite tiger shot recently in the Nilgiris.

The tiger was enormously fat but unfortunately it was not weighed, and measured 10 ft.

The male organ was above and the female lower down. Both were very small.

The tiger was never seen with any other tigers, and has been well known for about a year 14 miles to the west of Ootacamund.

If you have any record of an hermaphrodite tiger please let me know.

LOURDESVILLE,
OOTACAMUND,

November 9, 1941.

C. FRASER.

II.—THE INDIAN WILD DOG.

(A correction).

In my article on 'The Indian Wild Dog' (*Journal*, Vol. xli, page 695) I pointed out under the heading *colouration* that Mr. Dunbar Brander states in his book, 'Wild Animals in Central India', that in the C. P. the white tip to the tail is much more common than the black tip.

Mr. Dunbar Brander brings to my notice that his meaning as expressed in his book at page 28 was not perhaps sufficiently explicit and I have quoted him under a misapprehension of his meaning. The sentence quoted, he points out, should be read together with the previous sentence in the book. He never meant to convey that a white tip to the tail is common, but that it is common for the grey hairs within the black tuft of the tail to amount to a small white tuft within the large black tuft.

I am glad to enter this correction to make it clear that white tips to C. P. wild dogs' tails are not common. The three lines below Dunbar Brander's description as excerpted in my article should be deleted when being read.

BANGALORE,
October 28, 1941.

R. W. BURTON,
Lieut.-Col.,
Indian Army (Retd.).

III.—WIDESPREAD RABIES AMONG WILD DOGS ON THE BILLIGIRIRANGAN HILLS (S. INDIA).

Rabies among wild dogs on the Billigirirangans, and surrounding areas, is so widespread that a considerable number of Sholagas (aborigines) in all parts of the hills have been attacked and bitten; one has already died of hydrophobia. Cattle have been bitten, and domestic dogs. Three coolies on one of the coffee estates were bitten; the wild dog entering into their house. The dog was killed; as also another which made repeated attacks on a cartman. The brains of both these dogs have been reported as positive for rabies by the Pasteur Institute.

Two or three other dogs have been killed by the local Sholagas. The disease is reported to be spreading.

R. C. MORRIS,
Captain.

IV.—A COIN LODGED IN A TIGER'S PALATE.

Captain Chetwode's interesting note under this heading in your *Journal*, Vol. xli, No. 1, appears to have remained unanswered.

I do not think there is any reason to suppose that the tigress was a 'maneater', or that the coin was fired from a gun.

In many parts of India, cattle and especially young calves of both cows and buffaloes, are decorated with necklaces of beads and charms, among which are frequently seen pice and metal talismans.

This rather exceptional case might have arisen by the tigress killing an animal so decorated.

In the heat of excitement a bite on a worn coin, might easily have embedded it into the roof of the mouth. Time healing and causing it to adhere to the roof of the mouth of the tigress.

BELA HARIYA, A ST. JOHN MACDONALD.
BRIDGMANGUNG,
DIST. GORAKHPORE, U.P.
October 11, 1941.

V.—MEASUREMENTS OF AN INDIAN BISON HEAD (BIBOS GAURUS).

I enclose the measurements of the head of a very old solitary bull bison which died of old age lately in the Travancore Game Sanctuary. He was well known to visitors to the Sanctuary and was the subject of many a photograph.

This head has now been placed in the Government Museum at Trivandrum.

I also enclose for comparison the measurements of the largest head which was in the Museum prior to this.

I believe the head now placed in the Museum constitutes a World's record, but would beg you or any of your readers to kindly let me know whether I am correct about this.

	Measurements of the new bison head.	Measurements of the largest head in the Museum.
Tip to tip ...	29.7"	26.9"
Spread (extreme width) ...	43.7"	43.3"
Girth of horn ...	17.8"	17.0"
Length along outer curve of right horn ...	32.5"	30.7"
Length along inner curve of right horn ...	25.7"	25.0"
Weight ...	45.5 lbs.	33.5 lbs.

GAME WARDEN,
TRAVANCORE,
November 12, 1941.

S. C. H. ROBINSON.

[The record Indian Gaur head measures as follows. Tip to tip 39; spread 44 $\frac{3}{4}$; girth of horn 20; length along outer curve 31 $\frac{1}{2}$. The animal was shot in Siam by Lt.-Col. C. H. Stockleg. The largest head from S. India, measures tip to tip 34; spread 43 $\frac{3}{8}$; girth of horn 17 $\frac{1}{2}$; length along outer curve 30 $\frac{3}{4}$.—Eds.]

VI.—NOTE ON THE OCCURRENCE OF THE ENGLISH (?) PARTRIDGE (*PERDIX PERDIX* L.) IN NORTH PERSIA.

On the 24th October 1941 I was proceeding north from SENNA in Persian Kurdistan (approximately 90 miles north of KERMANSHAH.) Twenty miles north of Senna, close to HUSSAINABAD, at about 10 a.m., I saw a covey of birds, obviously partridges of some sort, run into a cover of willows and bushes on the banks of a mountain stream. I walked them up and killed a brace and, on picking them up found them to be, as I thought, unmistakable English partridges. There were about 14 birds in the covey.

The same day, 50 miles further north, at a small village called SENATA where I camped for the night, a covey of partridges settled in the field in which I was camped at about 5 p.m. I shot one of them.

I passed through Hussainabad again on the 26th of October and stopped to walk over the area in which I had first seen the partridges. I put up three coveys, each of 12-16 birds, and killed another brace.

On October 30, in the mountains about 15 miles west of Senna I put up another strong covey and killed one bird.

I killed more of these partridges at Hussainabad on November the 23rd.

On November the 24th when beating out a small plantation of poplars a mile south of Senna for Woodcock, in addition to the

Woodcock a solitary partridge also came out which I killed. An old bird.

I have been shooting partridges at home for close on 30 years and as far as I could see there was no difference between these birds and the English partridge. Silvery legs for old birds, yellow legs for young; some had complete chestnut horse-shoes on their breasts, some partial and some none.

They appear to live at an altitude of round about 6,000 feet. The places where I found them were all between 5,500 and 6,500 ft. The country consisted of mountains. Where the mountains were earth and stones, with patches of cultivation on the hill sides, one found the partridge, where they were rocky one found the chikor. The partridges appeared to be fond of the thickets of bushes of various kinds growing along the stream beds.

Unlike the partridge at home, they are great runners, and if found on open ground will continue running indefinitely rather than take to wing. If there is any further information I can give, I shall be glad to do so, and would be very interested in anything you can tell me about these birds.

BOMBAY,

'PERDRIX'.

5th January 1942.

[The Partridge (*Perdix p. perdix* L.), resident in the British Isles, is generally distributed over the greater part of Europe and is replaced by closely allied forms in the Alpine meadows of the Pyrenees, the Mediterranean, the Altai and Northern Persia.—EDS.]

VII.—THE NESTING OF THE MALABAR GREY HORNBILL.

Never having seen a hornbill's nest, I ran down to Khandalla on 14th April, 1941, with Br. Navarro of St. Xavier's College to examine a reported nest of the Malabar grey hornbill (*Tockus griseus griseus* [Latham]).

Hornbills were heard all morning, but when we reached the nest it was past 11 and most birds had stopped calling. The nest was 40 ft. up in a tree with the entrance facing a hill-side, where we concealed ourselves and waited. The male approached cautiously and silently, settled down on a lower branch and made a decided attempt to regurgitate. A small red berry appeared at the tip of its beak. The bird then visited the hole and shoved in its head and shoulders.

He came back without the berry and then went through the regurgitating and straining process again, producing another berry. It returned to the nest, apparently fed the invisible female and flew silently away. After half an hour, the male appeared again, carrying a dragonfly in its beak. We were, however, seen, and the bird flew off, returning by another route 20 minutes later, but still carrying the apparent lure. It took fright again and returned after 15 minutes, but now without the dragonfly. The bird was shot and about 25 red berries of *Ixora* sp. were found in its gullet, 10

more having spilled out as it fell. There was no trace of the dragonfly, but the stomach contained remains and seeds of 40 more berries. There was no trace of any covering to form packets of seeds, as has been suggested by other observers.

The female was taken off three naked young (two much larger than the third) and an addled egg. She had finished moulting her wings, but the new quills were too short for use. The tail was also moulting, the new rectrices being only 2 inches long, while four of the old feathers remained. There was no body moult. Patches under the tree showed that the female ejects her faeces from the hole.

Br. Navarro who has examined several other nests tells me that the male feeds the female the whole day. It is extremely noisy in the morning and the cackling suddenly stops at about 10. The feeding continues and the bird becomes noisy again at about 5 in the evening. He has also noted all nests in holes facing a hill-side.

He has noted the male tapping at the entrance, patiently waiting the female's consent to be fed. Considerable waits are involved, but the tapping continues.

Several factors appear to have been established, but a more detailed account of this bird's strange nesting habits would be of interest and value.

BOMBAY,

January 17, 1942.

HUMAYUN ABDULALI.

VIII.—THE IDENTIFICATION OF THE SMALL CUCKOO.

A hepatic Small Cuckoo (*Cuculus poliocephalus poliocephalus* Latham) from Khandalla (Navarro, 15th October, 1935) with a 145 mm. wing caused a lot of trouble in identification, and I might draw attention to the difficulties experienced.

The *Fauna* is wrong in requiring a 150 mm. wing for this species, and if it were not for another skin in the St. Xavier's College Collection (Palacios, Khandalla, Oct. 1931), wing 140 mm., named by Whistler, I might still have been guessing at its identity.

Similar birds from Assam in the Society's Collection are wrongly labelled *Cacomantis merulinus*. This species is much larger than *Cacomantis* and *Penthoceryx*, and in hand the hepatic phase may be separated from the latter by the black bands across the breast being much broader and thicker, and the head being generally darker. The white spots along the shafts of the tail feathers are also distinctive.

A third bird in normal plumage from the same locality also obtained in October (wing 148 mm.) appears to indicate that it is a common passage migrant (?) as in Dhulia (Davidson, Sept. Oct.) though a white egg 19×14 mm. from a tailor bird's (*Orthotomus*) nest (15th June, 1941) is attributed to this species. There is no record the Small Cuckoo from the immediate neighbourhood of Bombay.

BOMBAY,

January 17, 1942.

HUMAYUN ABDULALI.

IX.—THE COMMON HAWK-CUCKOO OR BRAIN FEVER BIRD.

A common hawk-cuckoo (*Hierococcyx varius*) laid two eggs in a crow's nest in my bungalow compound. The foster parents, who to my mind appear to be rather perturbed with the results, are at present busy feeding the young cuckoos.

There are two points which I think might be of interest.

First. Is it usual for a cuckoo to lay two eggs in one nest?

Second. I always understood that a cuckoo laid its egg or eggs (?) in the nest of a bird smaller than herself.

BISHNAUTH,

ASSAM,

September 19, 1941.

D. G. MESTON.

X.—THE DISTRIBUTION OF THE ROSY TERN

Messrs. Whistler and Kinnear in their report on the Eastern Ghats Ornithological Survey (*J.B.N.H.S.*, xxxix, p. 249) refer to the fact that there appear to be no specific records of the Rosy Tern (*Sterna dougalli korustes* Hume) in the Madras Presidency, and object to its inclusion in Baker and Inglis's 'Birds of Southern India'.

On a recent visit to Madras, I dropped in at the Government Museum, and was surprised to see a group case, showing a pair hovering over eggs, labelled 'Rameswaram Island—June 1914'. With the kind assistance of Dr. Aiyappan of the Museum, both the identity of the bird and the correctness of the data have been confirmed.

BOMBAY,

October 20, 1941.

HUMAYUN ABDULALI.

[Subsequent to the above note we had the following letter from Mr. Abdulali:

'In continuation of my letter and notes of the 30th ult., I might mention that "Viziadrug" (which locality was apparently untraceable *J.B.N.H.S.*, 39, p. 248 under *Thalasseus bergii velox*) is a small port on the west coast between Ratnagiri and Malwan, and has therefore nothing to do with the Madras Presidency. In that excellent map accompanying the third volume of the Fauna, it appears as "Vijayadrug".'—Eds.]

XI.—SOME BIRDS SEEN FROM THE TRAIN IN THE MADRAS PRESIDENCY.

A glance at that valuable and impressive report on the birds collected by the Vernay Scientific Expedition of the Eastern Ghats, will reveal the paucity of information regarding the most common species in the Madras Presidency.

On the 12th October I went down to Madras by train and took the Eastern Ghat papers with me for reference. We had hardly crossed the Tungabhadra River into the Madras Presidency, when almost every bird seen appeared to add to the information available. I was in Madras for only two days, and notes were kept on the return journey also. While none of the notes claim to be revolutionary or startling, they fill apparent gaps in our information and suggest possibilities of bird watching from trains in these days of petrol rationing. I need hardly stress that without an authoritative reference in hand, it is impossible to discriminate between the relative value of observations. These notes—for whatever they are worth—would never have been written if I had not had the survey reports with me.

South of the Tungabhadra, Brown Doves, Green Bee-eaters, King-crows, Bay-backed Shrikes, Blue Jays, Kestrels, Brahminy and Pariah Kites were common almost all along the line.

The other records are detailed together with extracts from the survey report in parenthesis.

Argya caudata at Kupgal near Adoni. ('Few records').

Saxicola caprata subsp. This was common round Adoni. There were *Agave* hedges running on both sides of the railway, and the birds appeared partial to them. Fewer birds were seen further south (where these plants are less prominent), though one was noted at Arkonam. Strangely enough, no *saxicoloides* were seen anywhere.

Lanius excubitor. More than one bird seen near Adoni. This appears to be a fresh record for Madras.

Temenuchis pagodarum at Kupgal near Adoni. ('Southern portion of the Northern Circars').

Passer domesticus. Seen at Adoni and Guntakal Stations. ('No information if it occurs north of Madras'.)

Motacilla alba. One seen near Madras.

Merops supercilialis subsp. A few single birds were seen round Madras, but they appeared commoner and more numerous around Tadpatri, 30 miles south of Gooty (Anantapur Dist.) The movements of both sub-species are very imperfectly known and further notes would be of interest. In the Bombay-Salsette paper (*J.B.N.H.S.*, Vol. xl., p. 169) we have referred to both *persicus* and *javanicus* as passage migrants in Sept.-Oct. and treated the latter race as the apparently regular and common form. These birds are commonly met when snipe shooting, and it is strange that two birds subsequently obtained (Dharamtar Creek, 17-xi-40 W—155 and Bhyander 19-x-41 W—150) should both be *persicus*!

Tockus birostris. Four seen flying through a palmyra grove at Kupgal, just south of the Tungabhadra. ('Not recorded north of Palkonda Hills').

Micropus affinis. Dewar says 'it is not very frequently seen in Madras', but I found it the commonest bird there!

Butastur teesa. Not found by the Survey and said to be scarce in the Presidency. At least four birds were seen in the open country between Cudappah and the Tungabhadra.

Streptopelia decaocto. Often noted south of the Tungabhadra

though not procured by the Survey ('appears to be far less common in the Presidency than in other parts of India').

Butorides striatus seen at Madras. ('Occurrence on eastern side of the Presidency has not been substantiated beyond the fact that a local specimen in the Madras Museum is apparently the basis for its inclusion in Dewar's Madras list.').

BOMBAY,
November 30, 1942.

HUMAYUN ABDULALI.

XII.—THE DISTRIBUTION OF THE NUKTA OR COMB DUCK IN SIND.

While shooting on the Bakarwari Dhand, near Sujawal, Karachi District, on the 27th December 1941, two comb duck (*S. melanotus*) were seen together by me.

I shot the female, and the skin is in my possession.

As this is a very rare duck in Sind, I am reporting the matter in case you desire the information for record.

On the previous day the bag from an adjoining dhand included one female cotton teal.

EXECUTIVE ENGINEER,
KARACHI BUILDINGS DIVISION,
VICTORIA ROAD, KARACHI,
January 11, 1942.

N. H. MENESSE,
I.S.E.

[According to Dr. Ticehurst (*Ibis*, vol. v., p. 443, 1923) the Comb Duck only occurs in the Southern and Eastern portions of the Sind Province, nearly all the records being from the Sujawal District.—Eds.].

XIII.—OCCURRENCE OF THE CHINESE HAWK-EAGLE (*SPIZAËTUS N. FOKIENSIS* KIRKE-SWANN) IN THE CHIN HILLS.

I enclose the skin of a hawk or eagle shot at Falam in the Chin Hills Burma altitude 5,300'. Would you please identify the bird and let me know the result.

BURMA FRONTIER FORCE,
FALAM,
CHIN HILLS,
BURMA,
June 1, 1941.

A. C. MOORE,
Major.

[The bird forwarded to us by Major Moore is an example of the Chinese Hawk-Eagle (*Spizaëtus nipalensis fokiensis* Kirke-Swann). The distribution is stated to be S. China south to the Indo-Burmese countries and Tenasserim.—Eds.]

XIV.—THE CROCODILE IN BURMA.

I should be interested to know whether any of your readers can throw some light on the distribution of crocodiles in this country.

As far as I can ascertain, the only common Crocodile here is *Crocodilus porosus*, which is confined to the mud banks and mangrove swamps of the coast of Tennasserim and certain parts of the Delta.

Although Peacock in his 'Game Book of Burma' states that both *Gavialis gangeticus* and *Crocodilus palustris* (or possibly *C. siamensis*) rarely occur in the Irrawaddy I have never met anyone who has confirmed this observation. Even if rare specimens do sometimes occur it seems to me a remarkable fact that these two species have been unable to establish themselves in any numbers in the Irrawaddy when they are so common in the Indus, Ganges and Brahmaputra. Although crocodiles are now unknown near the town of Pegu, Ralph Fitch who visited it in 1590 tells us that the moat was full of these reptiles. Sangermano who visited Burma two centuries later states that 'Crocodiles are not very numerous in the great river Ava (Irrawaddy)' which would rather point to the fact that crocodiles did once inhabit our rivers but are now almost extinct there. This view is rather endorsed by the name Migyaung-ye literally (Crocodile Water) which is a town situated on the river some 250 miles up from the mouth of the Irrawaddy.

Although I have frequently asked Burmans living on the banks whether they have ever seen crocodiles in this area, they all replied in the negative though some of them added that they often met their young on shore. By their young however they explained that they meant the 'Hput' (*Varanus monitor*) which is common in the Dry Zone and which many Burmans believe transforms itself later in life into a crocodile.

BHAMO BATTN.

J. A. M. SYMNS.

BURMA FRONTIER FORCE,

September 10, 1942.

[Of the various species of crocodiles occurring within our region *C. porosus* is known to occur in Burma. As regards *C. palustris*, its existence in Burma is at present doubtful. Theobald (1868) recorded a large specimen from Thayetmyo and remarked that it was the only specimen he had ever seen in Burma. There is no record of its having been obtained since. As regards *Gavialis gangeticus*, it is said, in the new edition of the *Fauna*, to occur in the Kaladan river, Arrakan. Barton '1929' records a specimen shot at the mouth of the Maingtha, a tributary of the Sweli River, Upper Burma. It is the sole record from the Irrawaddy river system.—Eds.]

XV.—NOTE ON AN EXPERIENCE WITH AN INDIAN PYTHON (*PYTHON MOLURUS*).

Some twenty-eight years ago in the low country of the Province of Uva, in Ceylon, one cloudy afternoon I wounded a spotted deer. A Sinhalese village tracker and I followed the blood spoor, the Sinhalese leading. The spoor went down into a small gully containing running water and up the other bank along a game track,

The tracker was running about six or seven yards ahead of me, up the bank, when I saw about six feet of a python dart suddenly at the calf of the man's leg and as suddenly withdraw. I could have sworn that the snake's head had made contact with the man's leg. I naturally stopped dead at seeing what had happened and called to the man. He stopped and turned and I told him what had happened. He said he had not been touched. We then looked into the dense undergrowth by the game path and, within two feet of the path, there was a 'pile' of python neatly arranged. The Sinhalese jungle villager remarked 'they never catch a man'. I killed the snake, which measured some fourteen feet, and it was difficult to get the python off its anchorage. Since then, I have asked many Ceylon jungle folk whether a python will catch a man and have been invariably informed 'no'.

KANDY,

CEYLON,

September 21, 1941.

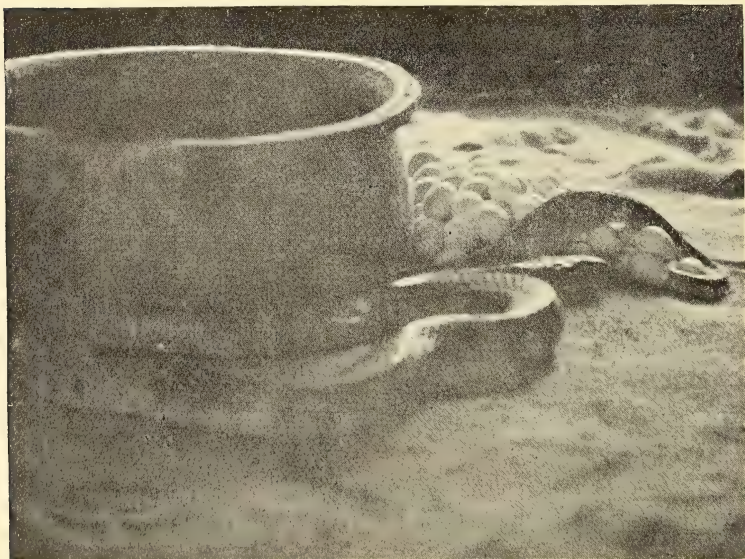
F. J. S. TURNER.

Ceylon Forest Dept. (Retd.)

[While the Indian Python may attack a man, there appear to be no authentic records of this snake actually overcoming or swallowing a man though capable of doing so.—Eds.]

XVI.—THE NUMBER OF EGGS IN THE CLUTCH OF THE CHECKERED WATER-SNAKE (*NERODIA PISCATOR*).

(With a photo).



With reference to the note on the record number of eggs (88) laid by the Chequered Water Snake, *Nerodia piscator*, published on p. 225, Vol. xxxii of this *Journal*, I wish to report that this record has been slightly raised by a specimen kept in the

Trivandrum Zoo, laying 91 eggs on 29-1-42. The eggs were of the usual type described for this species. The snake took one minute to void the egg that I watched, while the interval between two successive voidings was 10 minutes. One egg taken at random measured $9/10$ in. \times $8/10$ in.

Major Wall, on p. 864, Vol. xvii, of this *Journal*, instances two cases of this snake extruding eggs into water. In the present case however, it may be seen from the picture that the snake has chosen to lay beside the *gumlah* of water, though it was seen to rest coiled up in it for hours together the previous day.

GOVT. MUSEUM,
TRIVANDRUM,

N. G. PILLAI.

February 18, 1942.

XVII.—GLOW-WORM (*LAMPHROPHORUS NIPALENSIS* H.) FEEDING ON A SLUG.

In your letter dated 9/9/38 you mentioned that the larvae of the glow-worm *Lamphrophorus nipalensis* H. (*Malacodermidae*, *Lamphryinae*) were carnivorous and feed largely on land snails. It may be of interest to let you know that I saw one of these larvae feeding here last week. It was on an almost bare twig of a bush in the garden and was hanging head downwards clasping the twig with its extreme posterior pair of legs. Firmly held by the front legs was a slug about $\frac{3}{4}$ of an inch long and the larva was chewing its way into the slug from the head. Its mandibles could be clearly seen moving. There was also a good deal of froth round the insect's mouth. The slug was apparently dead but looked quite fresh. The time was 11-30 a.m. and the weather was sunny, but there had been heavy rain the night before.

DEBRUGARH,
LAKHIMPUR DISTRICT,
ASSAM.

R. E. PARSONS, F.R.E.S.,
Indian Police.

September 10, 1941.

XVIII.—THE PLANT-BUG *CYCLOPelta SICCIFOLIA* WESTW. ON *PONGAMIA GLABRA*.

On the 29th December 1941 at Khandala, W. Ghats, I observed large numbers of plant-bugs (*Cyclopelta siccifolia* Westw.) clustered together on the thinner branches of the *Curanj* trees (*Pongamia glabra*). These clusters, composed of about 50-100 bugs, were small when compared with the masses of bugs collected in the hollows of the trunks and main branches. These masses were often nearly a foot in diameter and from 3-6 bugs deep, all piled one on top of the other! The bugs were extremely sluggish and it was with more than gentle persuasion that they were induced to move. Even when knocked down it took them some time to 'wake up'. Judging from their behaviour it seems that the bugs had collected in this fashion to pass through the cold months. I brought a large number to Bombay in a cigarette tin, but the difference in temperature between the cold of Khandala and the warmer temperature of Bombay did not

increase their activity—they just huddled together in the tin. It may be of interest to note that these bugs only infested the *Pongamia* trees.

I noticed similar conditions while in Rajputana with a species of *Halys*. In this instance the bug's clustered in the hollows of Peepal trunks (*Ficus religiosa* L.). When the weather became warmer I found egg-clusters in the same hollows. This seems to suggest that the winter clusters bring together the sexes prior to the breeding season which follows hibernation (?). However, this is a point I must leave to future observation.

BOMBAY NATURAL HISTORY SOCIETY,
BOMBAY,

C. McCANN.

January 5, 1942.

XIX.—A BATTLE BETWEEN BLACK AND RED ANTS.

On June 28, 1941, I happened to witness a battle between a party of red ants (*Oecophylla smaragdina*) and a column of black ants (*Camponotus* sp.) in which several of the latter were taken prisoner, and subjected to the stretching process described in Major R. W. G. Hingston's illuminating study of the Red Ant on p. 681, Vol. xxix of this *Journal*.

I was coming up the path leading to the Museum when I noticed a column of black ants in front of me, crossing the path and making for the lawn on the right side. As there was nothing unusual, I was about to move on, when a number of curious patterns fixed to the floor and sides of the drain, near the point where the ants crossed it caught my attention. Each had a black line in the centre, surrounded by a number of brown strands radiating from it, reminding one of the structural formulae in books of Organic Chemistry. On nearer approach, I found that the black ants were being attacked by a party of red ants as they crossed the drain, and that the black ants, captured during the fight, were put 'on the stretch' by the conquerors which hooked themselves by their jaws to the limbs of the prisoners, somewhat in the manner of the spokes of a wheel.

These red ants were part of a large colony which lived on a neighbouring tree. Disposing themselves on the floor and left slope of the drain, so that they had the left flank of the black ants exposed to their attack, they crept up to the enemy line and waited with waving feelers for a suitable 'jawhold' on the passing ants. In a moment one of them would dart forward, seize a black ant by the leg and pull the victim towards it. The captive struggled, but nothing was of avail against the steady pull of the red ant, which by now, with its legs firmly planted on the ground and with abdomen slightly tilted, set about its task in a determined manner. A passing red ant soon turned up and offered to help by taking hold of one of the legs and pulling it in the opposite direction. One by one, more ants collected on the spot and following the example of the others, took hold of the remaining limbs and helped to keep the prisoner down until the curious patterns referred to above were formed.

The chief strategy of the black ants in this conflict was flight under cover of a rear guard action fought by a few which separated from the column and faced the enemy. There they stood eyeing

each other, ready to attack. But suddenly a red ant would dash forward and seize his opponent by the leg. Invariably the red ants were the victors in these frontal attacks. None of them was captured as the black ants seemed to be mainly on the defensive and attempted only to engage the enemy while the majority escaped. But occasionally a red ant slipped from the rather steep slope of the drain into the middle of the enemy's ranks, when they closed in on it like Furies and meted out swift punishment.

The battle lasted for about 3 minutes until the last of the black ants disappeared over the ledge of the drain.

GOVERNMENT MUSEUM.

N. G. PILLAI.

TRIVANDRUM

October 10, 1941.

XX.—WANTED MALE SPECIMENS OF THE BEETLE
(*ALLOMYRINA DICHOTOMUS*) FROM INDIA.

(With a photo).



Allomyrina dichotomus. (Nat. size.)

Would you please refer to my note on the beetle, *Allomyrina dichotomus* published on page 668 of Volume XLII of the *Journal*? I have since received another letter from Mr. Gilbert Arrow on this subject. He has sent me a photograph of the male of this

species; specimens of which sex he is very anxious to examine. This photograph I enclose herewith since you may like to publish it with a view to assisting him to obtain specimens. He mentions that the photograph is natural size and represents a specimen from China. Apparently, Indian males are likely to differ slightly from the Chinese males and specimens are required to investigate this matter.

SHILLONG,
ASSAM,

R. E. PARSONS, F.R.E.S.

February 2, 1942.

XXI.—THE DISTRIBUTION OF THE SCORPION (*HORMURUS NIGRIPES* POCKOCK).

In October 1941 M. W. A. Hewitt, District Traffic Superintendent, B.N.W. Rly., Gonda U.P., sent two scorpions which were identified as *Hormurus nigripes* Pocock.

As recorded to date, the distribution of the species is:—Panch Mahals in Gujarat (*Wallinger*); Satna in Central Provinces (*Dane*); Almora in United Provinces (*Hewitt*).

BOMBAY,

J. F. CAIUS.

November 12, 1941.

XXII.—ADDITIONS TO THE FLORA OF WAZIRISTAN.

Papaveraceae.

Papaver polychaetum. Wana, S. Waziristan. Open stony plain L 642 21-4-39.

Glaucium squamigerum Kar. et Kir. Inzar Narai, Near Wana, ca. 5,000'. L. 652. 29-4-39. Also at Tanai and Toi Khula, S. W.

Geraniaceae.

Geranium Wallichianum. Alexandra Ridge, Razmak, ca. 7000' L 9. 1932.

Papilionaceae.

Astragalus ancistrocarpus. Wana, 8-4-39, L 640. In seed, 14-5-40, L 678.

Astragalus purpurascens, Bunge. Inzar Narai, nr. Wana, ca. 5,000'. 29-4-39. L 654.

Onobrychis dealbata, Stocks. Inzar Narai, nr. Wana, ca 5,000' 29-4-39 L 651.

Calophaca ternata, Popow. Inzar Narai, nr. Wana, ca 5,000', 29-4-39. L 649.

Primulaceae.

Primula floribunda. Ladha, SW. 1921.

Compositae

Scorzonera papposa DC. Wana, 24-4-39; No. 645.

Senecio Desfontainei Druce. Wana, 24-4-39; No. 646.

Achillea santolina. Wana, S. Waziristan. In flower 13-5-40. On banks between fields. No. 676.

Nonnea picta. Wana, S. Waziristan. In flower 28-3-40. Fields and cultivated land. No. 670.

LANDI KOTAL,
September 2, 1941.

D. G. LOWNDES,
Major.

XXIII.—FASCIATED INFLORESCENCE OF *ACROCARPUS*
FRAXINIFOLIUS WIGHT.
(With a photo).



Photo by

M. Bakhshi.

Fasciated inflorescence of *Acrocarpus fraxinifolius* Wight.

An interesting case of fasciation of an inflorescence was discovered in the grounds of the Forest Research Institute last March. The species in question was *Acrocarpus fraxinifolius* Wight, a species widely distributed in the evergreen forests of India and Burma, and which ordinarily has an inflorescence consisting of short pendulous axillary racemes.

In the accompanying photograph one portion of the inflorescence consists of one very stout raceme, which approximates to the ordinary raceme, but which nevertheless, betrays signs of fasciation. The other portion, however, exhibits extreme fasciations in that the nodes of the shoot have become suppressed and the racemes all arise at one point, finally becoming fused together in a flattened fan-like structure. This portion was 9 inches long and 8 inches broad.

FOREST BOTANIST,

N. L. BOR.

FOREST RESEARCH INSTITUTE,

DEHRA DUN.

November 17, 1941.

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AUGUST, 1942.

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REV. J. F. CAIUS, S.J., F.L.S.

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Garwood

The Potato Creeper.
SOLANUM SEAFORTHIANUM Andr.
(nat. size).

JOURNAL OF THE Bombay Natural History Society.

1942.

VOL. XLIII.

No. 2.

SOME BEAUTIFUL INDIAN CLIMBERS AND SHRUBS.

BY

N. L. BOR, M.A., D.SC., F.L.S., I.F.S.,

Forest Botanist

AND

M. B. RAIZADA, M.SC.,

Assistant Botanist,

Forest Research Institute, Dehra Dun.

PART XI.

(Continued from Vol. xliii, No. 1 (1942), p. 10).

(With 1 coloured and 3 black and white plates and 9 text-figures).

[*Solanaceae* (continued).

2. *Solanum* Linn.

THE DEADLY NIGHTSHADE FAMILY.

(This plant name is mentioned by Celsius in his *De Medicina*, published in the first century. In the Middle Ages such names as *Solatrum*, *Solaticum*, etc. were applied to *Solanum nigrum*. Other authors derive it from *Solamen*, a Latin word meaning solace or quieting, which may have a reference to the narcotic properties of some species of the *Solanaceae*).

This genus contains a vast group (over 2,000) of temperate and tropical herbs, erect or climbing shrubs and even trees, glabrous or woolly, often spiny. Leaves usually alternate, entire or lobed, rarely pinnate. Inflorescence of solitary flowers or of pedunculate or subsessile fascicles of terminal or axillary cymes. Calyx funnel-shaped, angled or not, rarely entire, usually lobed, slightly or not

DEC 17 1942

enlarging in the fruit. Corolla rotate with a very short tube, 5-10- (4-6-) lobed; lobes glabrous or more often woolly, flat or shallowly channelled. Stamens the same number as the corolla lobes; filaments short, inserted in the throat; anthers erect, contiguous, forming a tube around the style, dehiscing by pores or by very short slits at the top of the anthers. Fruit a two-celled, round berry; seeds numerous.

The genus *Solanum* contains a number of food plants of which *S. tuberosum*, the potato, is perhaps the best known. The egg-plant, *S. melongena*, and the tomato, *S. lycopersicum*, also belong to the genus. It may be, perhaps, well to mention here that brinjal and tomato are the actual fruits of the plant, while the potato is a tuber developed on the roots.

Several Indian species of *Solanum* are poisonous on account of the presence of an alkaloid, solanine, in their tissues. The drug is said to be present in the potato close to the so-called 'eyes'. It is found, however, that cooking renders these poisonous plants innocuous. The leaves of several species of *Solanum* are smoked in a *chilam* like tobacco and are considered to give relief from tooth-ache, the belief being that the smoke kills the insects which are supposed to cause the pain.

A good many species, both indigenous and introduced, are cultivated in gardens for their handsome flowers and often spiny foliage.

KEY TO THE SPECIES.

Shrubs, young parts more or less pubescent.

- | | |
|--|-----------------------------|
| Flowers small, less than .5 in. in diameter, white... | <i>S. pseudo-capsicum</i> . |
| Flowers .75 in. or more in diameter, violet with a central yellow spot. | <i>S. Rantonnetii</i> . |

Climbers.

- | | |
|--|---------------------------|
| Flowers 1.5-2 in. in diameter | <i>S. Wendlandii</i> . |
| Flowers under 1.5 in. in diameter | ... |
| Lower leaves pinnatisect | <i>S. Seaforthianum</i> . |
| Lower leaves lobed, but not pinnatisect | <i>S. jasminoides</i> . |

Solanum pseudo-capsicum Linn.

JERUSALEM CHERRY.

(*pseudo-capsicum* means false *Capsicum* and bears witness to this plant's similarity to that genus).

Description.—A small leafy shrub reaching a height of 3-4 feet. Branches slender, cylindrical, glabrous, green. Leaves alternate, bright green and shining, shortly petiolate, lanceolate, oblong-lanceolate, oblanceolate or narrowly elliptic, narrowed gradually at the base into the short petiole, obtuse or obtusely acute at the apex, membranous in texture, glabrous or minutely pubescent and smooth on both surfaces, sinuate on the margins; nervation prominent below.

Flowers solitary or in few-flowered fascicles, seated on pedicels up to .5 in. long. Calyx .25 in. long, turbinate, glabrous, 5-lobed;

lobes linear-acute, .1 in. long or more. Corolla white, up to .5 in. in diameter, star-shaped, rotate, 5-lobed; lobes apiculate. Stamens 5, alternate with the corolla lobes; filaments short; anthers erect, oblong, opening by apical pores, at any rate at first. Style slender, glabrous. Fruit a yellow or scarlet globose berry, .5-.75 in. in diameter, which persists for a long time.



Fig. 1.—*Solanum pseudo-capsicum* Linn. $\times 1/1$.

Flowers.—August. Fruit ripens in May.

Distribution.—Native country uncertain. Indigenous or naturalised in Australia, South Africa, China, Madeira and Brazil. Comparatively recently it has also been naturalised in various parts of the Dun.

Gardening.—A low erect undershrub with white or purple flowers borne extra-axillary, solitary or in few-flowered, umbellate cymes.

The flowers are followed by scarlet berries which persist on the plant for a long time. It is an old fashioned plant and is grown usually in pots for its scarlet fruit. Cultivation is by seed.

***Solanum Rantonnetii* Carr.**

(This plant was named in honour of Rantonnet, a French horticulturist, who published several articles on species of *Solanum* about the middle of the nineteenth century).



Fig. 2.—*Solanum Rantonnetii* Carr. $\times 1/1$.

Description.—An erect bushy shrub reaching 3-4 feet in height. Stem covered with a dense short greyish or yellowish tomentum, almost quadrangular from the raised lines upon it which appear to be decurrent from the base of each side of the leaf-petiole. Leaves alternate, petiolate, lanceolate to ovate, up to 2.5 in. long, 1.5 in. wide, acute at the tip, attenuate at the base, covered with a short stiff pubescence on the upper surface or sub-glabrous; pubescence marked on the prominent nervation of the lower surface; petiole pubescent, .25-.3 in. long.



Photo by

Giant Potato Vine.
Solanum wendlandii Hook.
Indian Military Academy, Dehra Dun.

N. L. Bo

Flowers solitary or fascicled in the axils of the leaves, 1 in. or more in diameter, violet in colour with a central yellow spot. Calyx .1 in. long; turbinate, pubescent, truncate at the top and furnished with 5 linear processes. Corolla rotate, 5-lobed; lobes apiculate, covered with a short pubescence on the lower surface near the margins. Stamens 5; filaments slender, alternate with the corolla lobes; anthers thick, oblong, bright yellow, erect. Style slender, glabrous. Fruit about 1 in. in diameter, drooping, scarlet.

Flowers.—May–August. Does not fruit in Dehra.

Distribution.—Indigenous to the Argentine, widely cultivated in the plains throughout the country.

Gardening.—An attractive erect shrub growing up to 6 ft. It has a pretty deep green foliage and violet-coloured flowers with a yellow centre. The flowers are followed by red fruits an inch in diameter which make the plant very ornamental. The plant is not particular as to soil conditions. Frequent pruning will improve its appearance as the old branches become straggly and leafless. Easily grown from cuttings.

Solanum Wendlandii Hook.

GIANT POTATO VINE.

(This magnificent climber was named in honour of Dr. Wendland, Director of the Botanical Gardens, Herrenhausen, Hanover, who first sent it to Kew in 1882. Its home, however, is in Costa Rica).

Description.—A climbing shrub. Branches rather fleshy, cylindric, green, glabrous. Prickles on the stems, branches and petioles few in number, stout, recurved. Leaves alternate, very variable, the uppermost simple, oblong or elliptic, acuminate or apiculate on the tip, rounded, cuneate or cordate at the base, entire on the margin, membranous, glabrous, 1-4 in. long by 2 in. wide; the lower up to 10 in. long by 4 in. wide or more, divided or cut in various ways, pinnate with the terminal leaflet very large or deeply lobed, membranous, glabrous; midrib with a few recurved prickles below; petiole glabrous, 2-4 in. long, with 1 or 2 prickles.

Inflorescence of terminal pendulous cymes, 6 in. wide or more. Calyx campanulate, .3 in. long, glabrous outside, 5-lobed; lobes .1 in. long, ovate or oblong-apiculate, spreading in the opened flower, minutely hairy on the margins. Corolla lilac-blue or mauve in colour, up to 2 in. across, rotate, shallowly 5-lobed; lobes apiculate, hairy, induplicate in the bud. Stamens 5, alternate with the corolla lobes; filaments short, flat, inserted on the throat; anthers bright yellow, opening by slits, loosely connivent round the style. Ovary hairy, 2-celled. Fruit globose.

Flowers.—Rainy season. Does not fruit in Dehra.

Distribution.—Native of Costa Rica, now cultivated in all tropical and temperate parts of the world.

Gardening.—A magnificent climber with very large, pale lilac-blue flowers in pendulous cymes about 6 in. across. It grows luxuriantly, but if neglected becomes ragged. The flowers which

are mostly produced during the rainy season are very effective. This is perhaps the most showy of the cultivated *Solanums*. It



Fig. 3.—*Solanum Wendlandii* Hook. f. $\times 1/1$.

prefers partial shade and is a splendid object for a green house. It was introduced into the Royal Gardens, Kew, in 1882. Propagated easily by cuttings.

***Solanum Seafortianum* Andrews**

POTATO CREEPER.

(The plant was named in honour of Francis Lord Seaforth, a patron of botany).

Description.—A glabrous climber. Stems and branchlets slender, cylindrical or angled, glabrous. Leaves alternate, the uppermost

simple, elliptic-lanceolate, acute, seated on a petiole, .5 in. long, entire or undulate on the margins, membranous, glabrous on both surfaces; the lower trifoliate or pinnatisect, the leaf being cut to the midrib into a number of opposite segments which simulate leaflets; upper leaflets elliptic, narrowed at both ends; the next pair broad at the base and the rest almost petioled, all glabrous, acute or acuminate, entire or undulate on the margins; petiole up to 2 in. long.

Flowers arranged in axillary, rarely terminal, cymose panicles. Pedicels slender, up to .5 in. long. Calyx about .1 in. long, tube very short, obconical, glabrous, 5-lobed; lobes triangular-acute. Corolla rotate, .5 in. or more in diameter, blue or rose-coloured, shallowly 5-lobed; lobes hairy on the margins, induplicate-valvate in the bud. Stamens 5, alternate with the lobes; filaments short; anthers bright yellow in colour, oblong, connivent above the hairy style; ovary hairy, 2-celled. Fruit a globose berry, glabrous, scarlet.

Flowers and Fruits. July-September.

Distribution.—A native of Brazil now extensively cultivated in all tropical and sub-tropical parts of the globe.

Gardening.—A pretty, somewhat woody climber with bluish-purple flowers borne in axillary compound cymes. This 'vine' does well in the sub-Himalayan tract but not in the plains. It prefers cool situations and begins to flower even when very young. Multiplied by seed or cuttings. It was introduced into England in the year 1804.

***Solanum jasminoides* Paxt.**

POTATO VINE.

(*jasminoides* means jessamine-like, and refers to the leaves of this twiner).

Description.—A slender twining shrub. Branches cylindrical, glabrous, smooth. Leaves alternate, petiolate, 1.5-2 in. long, lanceolate or ovate-lanceolate in shape, round at the base, acute or obtuse at the tip, glabrous on both surfaces, somewhat coriaceous in texture, entire on the margins; nervation obscure; petiole about .5 in. long, terete, glabrous. Lower leaves sometimes lobed or pinnatisect.

Flowers white with a tinge of blue, star-shaped, arranged in terminal cymose panicles, about 3 in. across. Calyx .1 in. long, tube very short, 5-lobed; lobes nerved, ovate-acute or lanceolate-acute, glabrous. Corolla rotate, glabrous, 5-lobed; lobes spreading apiculate, shortly hairy towards the margins on the under surface. Stamens 5, alternate with the corolla lobes; filaments short; anthers oblong erect about the hairy style. Ovary hairy, 2-celled.

Flowers.—March-October. Does not fruit in Dehra.

Distribution.—Native of South America, commonly grown in gardens in the plains and hills throughout the country.

Gardening.—A pretty climber with ovate-lanceolate leaves. Flowers star-shaped white about .8 in. across in many flowered



Fig. 4.—*Solanum jasminoides* Paxt. $\times 1/1$.

cymes. It prefers well drained soil and partial shade and is a useful climber for the cool house. Propagated by cuttings.

3. *Datura* Linn.

(*Datura* is the Arabic name for the plant *Datura Stramonium* Linn.).

The genus comprises herbs, rarely shrubs or small trees, branchy, glabrous or slightly hairy, with a foetid odour. Leaves alternate, entire, or shallowly incised. The flowers are large, axillary and solitary. Calyx tubular, herbaceous, 5-lobed, rarely 3-lobed, splitting horizontally into 2 portions, the lower of which is persistent and surrounds the capsule, the upper deciduous. Corolla large, elongate, cylindrical at the base, widened at the top, 5-6-10-lobed or -toothed. Stamens 5; filaments inserted towards the base of the corolla tube and attached to it for half their length; anthers included, linear, dehiscing by longitudinal slits. Ovary 2-celled or imperfectly 4-celled; style long, filiform; stigma small, 2-lobed. Fruit an ovoid or globular capsule, spinescent, rarely smooth, opening by 4 valves or irregularly. Seeds numerous.

This genus contains from 20 to 25 species which are generally confined to the tropics, especially of South America, and of which several are cultivated for their large flowers which become scented towards the evening. The large flowers close during rainy weather so that the stamens and nectaries are protected from wetting.

Several of the species are said to be cross-fertilised through the agency of birds. Other agents of cross-pollination are beetles and moths.

The seeds, leaves and other parts of several species of this genus are very poisonous and also medicinal, and have been known as such from very early times. The alkaloids to be found in the plants are usually hyoscyamine and scopolamine. An interesting fact about *Datura* (quoted by Burkill) is that when the plants are de-flowered it is found that the amount of alkaloid is greatly increased.

KEY TO THE SPECIES.

Flowers erect or inclined, often purplish outside; fruit	
globose, armed with conical prickles.	<i>D. fastuosa.</i>
Flowers drooping, greenish white outside; fruit unarmed.	<i>D. suaveolens.</i>

Datura fastuosa Linn.

(*fastuosus* is a Latin word meaning proud; why it has been applied to this plant we are unable to state unless it refers to the erect flowers which in this genus are usually pendulous).



Fig. 5.—*Datura fastuosa* Linn. $\times \frac{1}{2}$.

Description.—An annual herb, glabrous, reaching a height of 4-5 feet. Branches purplish and spotted with white patches. Leaves alternate, long petiolate, obliquely and broadly ovate-acute, toothed or entire; 2.5-6 in. long by 2-5 in. wide; petiole 2-3 in. long. Flowers axillary, solitary, shortly pedunculate; peduncle .5 in. long, more or less. Calyx cylindrical 2-3.5 in. long, 5-lobed; lobes about

.5 in. long, lanceolate-acute. Corolla large, 6-10 in. long, trumpet or funnel-shaped, white, violet or tinged with purple, with 5-6 folds and 5-6 lobes which are more or less cuspidate. Stamens 5, filaments attached to the corolla tube for half their length; anthers .3 in. long. Ovary glabrous; style as long as the corolla; stigma capitate, bifid. Fruit a globose capsule, spiny, 1 in. in diameter, glabrous, indehiscent, opening irregularly at the top. Seeds flattened, furrowed, tubercled.

Flowers and Fruits.—Chiefly during the rains.

Distribution.—Native of India, wild or naturalized throughout the tropics of both hemispheres.

Gardening.—An erect herb 4-5 ft. high. The double and triple forms of this species which are common in cultivation, are extremely handsome when in bloom during the rains. Easily grown from seed.

Medicinal and Economic Uses.—The seeds of this plant are highly poisonous and have been in use for centuries for criminal purposes. The victim is drugged by means of food or drink to which the ground seeds have been added, as a preliminary to the theft of his property. The action of the poison is, however, so powerful that sometimes the victim does not recover. The leaves are of use for making cigarettes and fumigating powders for the relief of asthma. Ganja eaters often adulterate the ganja with datura leaves. The juice of this plant is believed to be a cure for hydrophobia. The leaves are boiled and used as a poultice to relieve pain.

Datura suaveolens Humb. et Bonpl.

ANGEL'S TRUMPET.

(*suaveolens* means sweet-smelling in Latin.)

Description.—This shrub reaches 10-15 ft. in height. Ultimate shoots green, terete, smooth and eventually glabrous, when young covered with a minute, evanescent tomentum. Leaves opposite, 6-12 in. long, 2-4 in. broad, one of the pairs about one-third shorter than the other, petiolate, ovate-oblong, quite entire on the margins, oblique at the base, glabrous, smooth on both surfaces, darker above, pale below, foetid when crushed; nervation prominent below; petiole up to 2 in. long, terete, finally glabrous, nodding.

Flowers axillary, solitary, seated on peduncles up to 1.5 in. long; peduncles smooth and glabrous, terete. Calyx 4-5 in. long, yellowish green in colour, tubular, 5-veined, ending above in five oblong acute lobes which are valvate in the bud, and through each of which passes a vein, glabrous within and without, smooth. Corolla greenish-white or creamy white, up to 12 in. long, trumpet-shaped, with a spreading plicate limb, shortly broadly and acuminate-ly lobed, 5-angled and narrow below, swelling above into the trumpet, which has three nerves to each lobe, minutely hairy outside, becoming glabrescent. Inside the corolla the three nerves of each lobe are deeply impressed, each group of three lying between



oto by

Datura fastuosa Linn.
New Forest, Dehra Dun.

N. L. Bor



Photo by

N. L. Bor

Angel's Trumpet.
Datura suaveolens Humb. et Bonpl.
New Forest, Dehra Dun.

the five filaments of the stamens. Stamens five in number, connate by the edges of the anthers into a column round the style; the filaments are quite definite and are adnate to the tubular part of the corolla and are only detached from it where the tube swells into

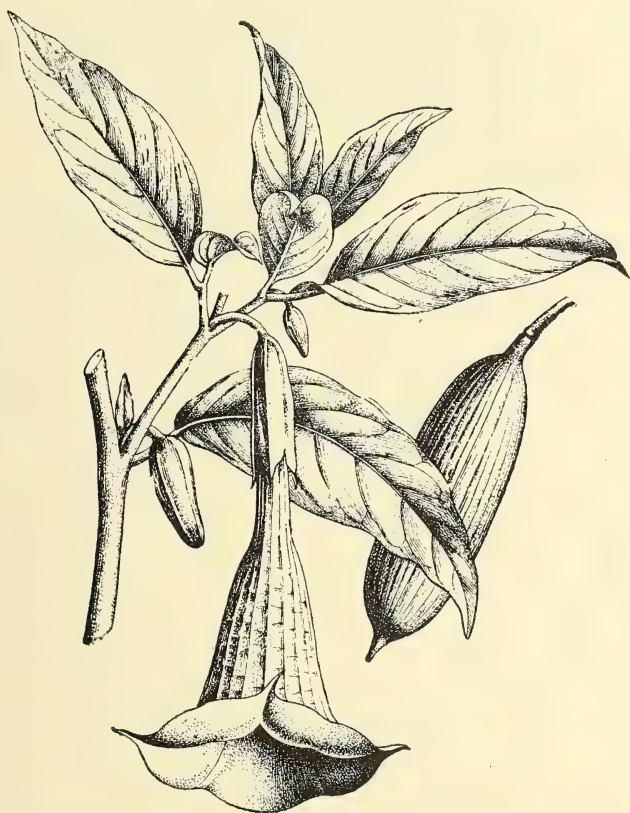


Fig. 6.—*Datura suaveolens* Humb. & Bonpl. $\times \frac{1}{2}$.

the trumpet; adnate filament and free filament, for a short distance above their attachment, villously hairy; anthers 1.5 in. long, connate by their margins and opening by slits outwards; pollen of perfect spheres. Ovary cylindrical at the bottom of the corolla tube, smooth and glabrous, 2-celled; ovules many. Style very long. Fruit spindle-shaped, up to 5 in. long, unarmed, devoid of any trace of the calyx.

Flowers.—Hot season. Fruits cold season.

Distribution.—A native of Mexico, frequently cultivated in gardens.

Gardening.—A large, tree-like shrub with large flaccid leaves and very large handsome, sweet scented, drooping, creamy-white flowers. A very showy, easily-grown plant which thrives in wet shady places such as the banks of streams. It does well in the

Sub-Himalayan tract but does not flourish in the plains. Easily grown from cuttings.

4. *Brunfelsia* Sw.

(Named in honour of Otto Brunfels 1489-1534, famous surgeon, theologian and botanist. His herbal 'Kontrafayt Kreuterbuch' brought him fame during his life time. The genus has also been named *Franciscea* in honour of Francis the First, Emperor of Austria, and at least one of the species may be better known to horticulturists under this name).

This genus contains mostly shrubs, but a few are small trees. The leaves are alternate, petiolate, entire, elliptic-obovate or narrowly elliptic, exstipulate. The flowers are usually large and showy and have the strange property of changing colour as they grow older; some change from mauve or blue to white, others from yellow to white, or white to yellow, arranged in terminal cymes or clusters; sometimes solitary, sometimes sweetly fragrant. Calyx gamosepalous, 5-lobed. Corolla salver-shaped; tube narrow long; lobes five, rounded. Stamens four didynamous; filaments attached to the throat of the corolla. Ovary superior; style included or slightly exserted; stigma 2-lobed. Fruit a berry.

KEY TO THE SPECIES.

Flowers mauve	...	...	...	...	...	<i>B. latifolia.</i>
Flowers yellow or white						
Small tree	...	...	...	...	...	<i>B. undulata.</i>
Shrub	...	...	...	...	...	<i>B. americana.</i>

Brunfelsia latifolia Benth.

(*latifolia* in Latin means broad-leaved).

Description.—A small shrub with spreading branches, and green smooth glabrous twigs. Leaves elliptic or oblanceolate in shape, 2-4 in. long, acute or obtuse, glabrous and dark green above, slightly pubescent and lighter green below, quite entire; nervation obscure. Flowers arranged in terminal clusters, or few-flowered axillary cymes. Calyx erect, campanulate, .5 in. long, glabrous and smooth, ending above in five, short, blunt, triangular lobes. Corolla hypocrateriform, pale violet or mauve in colour with a white centre, fading a few days after opening to a pure white; tube 1.5 in. long, slender, slightly curved; lobes 5, orbicular about .75 in. long, somewhat undulate. Stamens four, two long, two short, each pair connate by the kidney-shaped anthers. Filaments expanded and flattened below the anthers and attached to the corolla tube. Ovary superior, 2-celled. Ovules many, on axile placentas; style just exserted; stigma two-lobed.

Flowers.—Profusely in the hot weather, but is in a bloom practically throughout the year. Does not fruit in Dehra.

Distribution.—Native of tropical America; commonly grown in all tropical and subtropical countries of the world.



Fig. 7.—*Brunfelsia latifolia* Benth. $\times 1/1$.

Gardening.—A small low bush with slender branches and soft green leaves, which it sheds in the cold weather but which are replaced by the end of February, producing at the same time numerous sweetly scented flowers which are at first pale violet with a white centre but change in a day or so to white. For this reason it is often called by the popular name of 'Yesterday, To-day and Tomorrow'. It is rather a slow growing plant and usually cultivated in large pots though it flourishes equally well in the ground. It is slightly affected, especially when young, by frost when it is severe. It flowers very freely in the early hot weather, the pale-blue flowers against the dark green foliage producing a marvellous effect. It is a great favourite with Indians who invariably call it by the name of *Franciscea*. It prefers full sunshine or partial shade. Easily propagated by layers.

***Brunfelsia undulata* Sw.**

(*undulata* is a Latin word meaning wavy and refers to the margins of the leaves and petals).

Description.—An evergreen shrub or small tree which reaches 20 ft. in its own home. Leaves variable in shape, ovate-lanceolate, narrowly elliptic, oblanceolate or elliptic-oblanceolate, narrowly

cuneate at the base, obtuse or acute at the tip, entire on the margins, exstipulate, quite glabrous, 2-7 in. long, up to 1.5 in. wide, nervation rather obscure, finely reticulate, petiole .25 in. long. Flowers solitary and terminal in wild plants, in cultivated plants

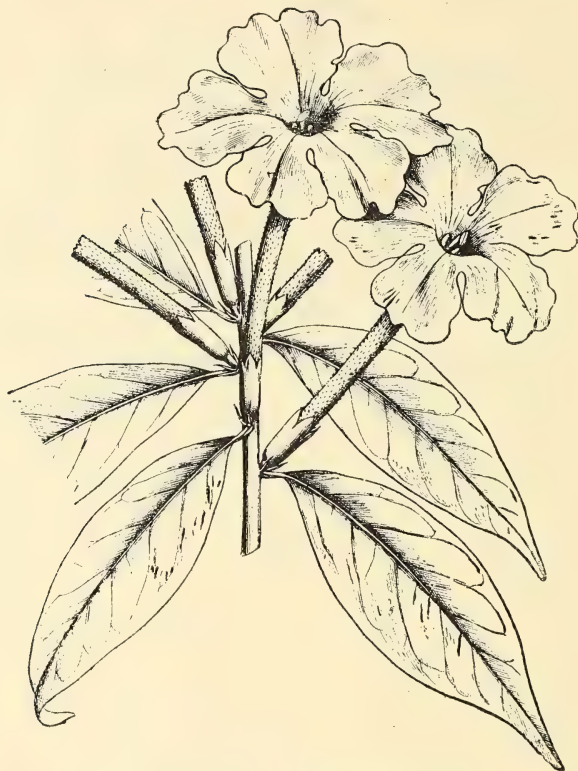


Fig. 8.—*Brunfelsia undulata* Sw. $\times 1/1$.

forming clusters in the upper axils. Calyx about .25 in. long, campanulate, somewhat irregularly 5-lobed, shortly glandular-pubescent externally. Corolla hypocrateriform, pure white fading to a creamy-white with age; tube cylindric, slightly curved, pubescent externally, up to 3.5 in. long, 5-lobed; lobes 5, 1 in. long, rounded, with undulate margins. Stamens 4, as long as the tube. Ovary oblong; style as long as the tube, slightly exserted, ending in a 2-lobed stigma. Fruit berry-like.

Flowers.—Rainy season. *Fruits* cold season.

Distribution.—Native of Jamaica, now frequently cultivated in all tropical and subtropical parts of the world.

Gardening.—An upright shrub very similar to *B. americana* Sw. It prefers a loamy soil and a sunny site. Propagation is by seeds or layers. It was introduced into England about the year 1800 from Jamaica. It is a magnificent free-flowering species and is a great acquisition to any garden.

***Brunfelsia americana* Linn.**Fig. 9.—*Brunfelsia americana* Linn. $\times \frac{1}{2}$.

Description.—A dwarf shrub with smooth glabrous or minutely pubescent branches and branchlets. Leaves 2-4 in. long, alternate, exstipulate, elliptic, elliptic-ob lanceolate, or elliptic-obovate in shape, cuneate at the base, obtuse or acute at the tips, dark green and glabrous above, paler and pubescent below, petiolate; petiole .1- .25 in. long; nervation obscure.

Flowers arranged in few-flowered terminal clusters or solitary in the axils of the leaves. Calyx campanulate, smooth and glabrous, divided above into 5 triangular-acute lobes, the whole including the lobes about .25 in. long. Corolla hypocrateriform, minutely pubescent outside, pure white fading to yellow, sweetly scented, especially at night, about 2-2.5 in. long and 1.5-2 in. wide at the mouth; tube very slender; lobes 5, broadly elliptic or orbicular in shape. Stamens 4, attached to the tube, didynamous; anthers reniform. Ovary superior, style almost as long as the tube, terete, glabrous, ending above in a two-lobed stigma. Loculi 2, ovules many on central placentae. Fruit a berry.

Flowers.—March-April with a second flush in October. Fruits cold season.

Distribution.—A native of tropical America now commonly cultivated throughout the tropical and subtropical parts of the globe.

Gardening.—An erect, dwarf shrub about 3 ft. high with slender branches. The flowers are at first pure white fading with age to pure yellow and sweetly scented specially at night. It is not so ornamental as *B. latifolia* Benth. except when in full bloom during March and October. It prefers full sun and is multiplied by layers as well as by seed.

THE BIRDS OF MYSORE.

BY

SALIM ALI.

With notes by Hugh Whistler.

Part I.

(With 4 plates).

The recent bird surveys of the Madras Presidency, Hyderābād, Travancore and Cochin States brought to light, among other things, some rather curious divergences between certain forms inhabiting the eastern and western sides of the Indian Peninsula. Their line of separation obviously lay somewhere in the intervening country of Mysore where no systematic work had hitherto been done¹. An investigation of this area thus became highly desirable, and by means of careful collecting of specimens and study of ecological conditions an attempt to reconcile and account for the existing differences in the geographical races of the east and west.

This survey was made possible primarily through the generosity of the Mysore Durbar, to whom the thanks of the Society and of all ornithologists are due. The welcome financial co-operation received from the American Museum of Natural History, New York, anxious to obtain fresh ornithological material from India, facilitated the field work further.

It was fortunate that the New York Museum agreed to our proposal that the entire collection should be entrusted to Mr. Hugh Whistler for taxonomical study before it was dispersed and they received their share. This has been a distinct gain to Indian ornithology. Mr. Whistler has been responsible for the examination of practically every systematically made regional collection in India during the last 15 years or more. His opportunities and experience in the handling of fresh Indian material have been unequalled. Continuity can now be maintained in the excellent notes he has contributed previously and in the course of this paper. As before, his constant advice and suggestions have been of considerable help in the field and I feel greatly indebted to him.

It would be impossible here to thank individually every one whose kindness and assistance enabled the smooth running of the work in the field. Sir Charles Todhunter, C.I.E., deserves particular mention. It was due to his keenness and initiative that the Society's original proposal regarding the survey obtained suitable response from the Mysore Durbar. Without the constant solicitude

¹ Besides the literature on Mysore ornithology quoted in the following pages, practically the only other publications with any claim to importance are:

1. 'Notes on Some Birds collected on the Nilgiris and parts of Wynad and Southern Mysore' by Wm. Davison (*Stray Feathers*, vol. x, pp. 329-419).

2. 'A Tentative List of the Birds of Munzeerabad, Mysore' by C. J. W. Taylor (*ibid.*, vol. x, pp. 454-67).



1. A portion of the Biligirirangan Hills showing typical lay-out of evergreen *sholas* or forested ravines.



2. Bird's-eye view (close-up) of a typical *shola* "roof".



3. A Coffee plantation with Silver Oak (*Grevillea robusta*) shade trees.

and unfailing help of Mr. C. Abdul Jabbar, Chief Conservator of Forests, and his various District Forest Officers and staff the survey would have been greatly hampered. My special thanks are due to my friends Major and Mrs. Randolph C. Morris, not only for the frequent and genial hospitality of their delightful home at Honnametti, but also for the very valuable contribution he has made at my suggestion to Mysore ornithology at considerable trouble and expense to himself. He engaged trained skimmers and collected intensively in the neighbourhood of his coffee estate in the Biligirirangan Hills during seasons of which the survey could, in its normal course, have gained no first-hand information. It is earnestly to be hoped that he will return at the end of the War to continue his good work on the natural history of the fascinating country where he lives.

Major E. G. Pythian-Adams, I.A. (Retd.), recently contributed a useful article on Small Game Shooting in Mysore (*J.B.N.H.S.*, Vol. xli, no. 3 (1940), pp. 594-606). That article was the outcome of many years' experiences of a keen and observant shikāri. It concerns chiefly the Mysore District and furnishes much fuller information on game birds than it would have been possible to obtain in one short seasonal survey. I could not have done better than draw largely upon this informative article. I am thankful to Major Pythian-Adams for letting me have a copy of some further notes on Mysore birds made by him from time to time, and also for allowing me to look over his collection of eggs chiefly from the Mysore District.

Col. R. Meinertzhagen, D.S.O., has been good enough to have some helminths from Mysore birds determined for me through the kindness of Dr. H. A. Baylis of the Zoological Dept., British Museum (Natural History). Unfortunately the material was meagre and inadequately preserved, but it is hoped that attention of field workers will now be drawn to this much-neglected branch of Indian ornithology.

Finally, a word of praise is due to my assistants Messrs. N. G. Pillai and J. Gabriel. Their keenness on the respective jobs assigned to each, and the care with which they prepared all the specimens, often under somewhat trying conditions, made it a pleasure to work with them.

PHYSIOGRAPHY.

The Mysore State, situated in S. India between $11^{\circ} 36'$ & $15^{\circ} N$ and $74^{\circ} 38'$ & $78^{\circ} 36'$ E is a more or less triangular tract of country lying wedged in between the Eastern and Western Ghāts, and covers an area of 29,433 square miles. Its greatest length N to S is 230 miles, its greatest width E to W 290. It is bounded on all sides by districts of the Madras Presidency except on the N-W where two Bombay districts (North and South Kanara) form the boundary, and towards the S-W where Coorg abuts on to it.

The area as a whole is an elevated tableland much broken up by rocky hills and scored by deep ravines. The hills, though rarely

connected in chains, run longitudinally more or less parallel to the Ghāts. Isolated peaks of massive rock called *droogs* rear their heads on all sides to an elevation of 4-5,000 feet. The apex of the triangle is to the south at a point where the Western and Eastern Ghāts converge in the group of the Nilgiris. The general elevation rises from about 2,000 feet along the northern and southern frontiers to about 3,000 feet at the central water parting which separates the basin of the Kistna to the north from that of the Cauvery to the south. The watershed divides the country into two nearly equal parts a little north of lat. 13° N and as far as long. 77° E where a transverse line marks the eastern watershed.

The drainage of the plateau as a whole is to the Bay of Bengal. It is divisible into 3 great river systems: the Kistna on the north, the Cauvery on the south and the Penner with the Ponnaiyār and Palar on the east. The Tūnga and Bhadra rising in the Western Ghāts unite into the Tūngabhadra a little north of Shimoga, and after receiving the Hagari or Vedāvati join the Kistna beyond Mysore limits, near Karnool. The Hemāvati, Shimsha, Kabbani, Arkāvati and other streams flow into the Cauvery which rises in Coorg. The only streams that flow into the Arabian Sea are those in the north-west. These unite with the Sharāvati and hurl themselves down the Western Ghāts in the magnificent Gersoppa or Jōg Falls. There is an extensive system of irrigation tanks (*keré*) and channels from the Cauvery and its tributaries by means of anicut dams. Sulekeré lake, about 30 miles N-E of Shimoga, is 40 miles in circumference. Marikānivé or Vanivilās Sāgar between Hiriyūr and Hosdrūg (Chitaldrūg District) is over 90 miles, while the latest to be completed, Krishnarajsagar near Mysore town, has a water-spread of about 50 square miles. And there are innumerable smaller tanks dotted all over the country.

The remarkable transformation wrought by canal irrigation is nowhere more apparent than in the country around Māndya (Mysore District). Large tracts until recently bare, open and stony moorum plains have been altered by the Irwin Canal and its numerous tributaries into a fertile, intensely cultivated area under sugar cane, rice, gingelly and other crops.

The two most important hill ranges are the Bābābūdan and the Biligirirangan. The Bābābūdan, the highest range in Mysore State, lies between $13^{\circ} 23'$ & $13^{\circ} 35'$ N and $75^{\circ} 37'$ & $75^{\circ} 52'$ E in the Kadūr District. It is in the form of a crescent or horse-shoe with opening to the north-west. Its character is that of a stupendous ridge *ca.* 6,000 ft. in elevation, in parts only a few yards wide along the summit, and rising at intervals into lofty peaks. The higher portions consist of steep grassy slopes cut up by well-wooded ravines or *sholas* through which flow perennial streams. The sides are densely clothed with forest among which are numerous coffee plantations. The Jāgar Valley which occupies the centre of this horseshoe with an elevation of about 2,000 ft. is one stretch of forest (Evergreen biotope: chiefly moist-inter zone) as far as the eye can see. The highest peak is Mūlainagiri (6317 ft.) towards the south of the range. North-east of this is Bābābūdangiri (6214 ft.) on which are the sources of the Veda and Avati rivers.



1. The edge of a *Shola*. Open hillside covered with tall, coarse *Andropogon* grass and sparse scrub. Favourite habitat of *Locustella naevia*, *Cryptoplectron erythrorhynchum* etc.



2. Secondary jungle facies of Deciduous Biotope. Typical habitat of *Franklinia gracilis* and numerous other birds.

The Biligirirangan Hills in the south-east of Mysore District originate at about $12^{\circ} 27' N \times 76^{\circ} 11' E$. After running N and S for about 10 miles the range passes into the adjoining Coimbatore District of Madras. Its highest peak, on which is situated the temple of Biligiri Ranga, is 5091 ft. The slopes of this range are well-wooded, teak and sandalwood being found among the trees. Long coarse grass 10 to 15 ft. high grows everywhere.

METEOROLOGY.

Mysore gets the greater part of its rainfall during the South-west Monsoon between June and October, but the North-east Monsoon, which follows immediately and prolongs the rainy season to about the middle of November, also exercises considerable influence in parts.

The annual precipitation varies between about 350 inches on the crest of the Western Ghāts and 19 inches in north central Mysore. But these extremes apply only to very limited tracts, and the general annual average for the greater part of the State is 25-40". The excessive rainfall of the Malnād region (described later) rapidly diminishes eastwards.

A zone of heavy rain (60" and over) is confined to the Western Ghāt region from Sorab to Manjarabad; 40-60" between Sorab and Shikārpūr in the Bābābūdans region and in Heggadedevankote. The zone of 25-40" extends over the remainder of the State except the Chitaldrūg District, the north of Tūmkūr and Kolar Districts and the extreme south-east of Mysore District which get less than 25". The distribution of rainfall here as in Travancore¹ is regulated by the physical configuration of the country, especially direction of the hill ranges relative to the strike of the S-W Monsoon currents. Naturally the forest belts closely follow its distribution, the ever-green belt coinciding with the heaviest rain, the deciduous forest with the less heavy and the dry scrub jungle with the least rain.

The minimum and maximum temperatures in the hottest months at Bangalore are ca. 66° and $91^{\circ} F.$ or in extreme seasons $96^{\circ} F.$ Chitaldrūg and the northern parts of the State are considerably hotter. The mean annual relative humidity is 66 as compared with 79 for Malabār and Coorg and 67 for the Carnatic (Blanford).

The country is conveniently divided into 2 clear-cut physio-graphical regions viz. the Malnād and the Maidān.

1. *Malnād* on the west, is confined to the tracts bordering or resting on the Western Ghāts (Shimoga, Kadūr and Hassan Districts). It is a picturesque tract of heavy rainfall and high humidity abounding in mountains and forests presenting diversified and beautiful scenery. This area contains the richest flora and is clothed with magnificent timber. The summits of the mountains are mostly bare of trees but covered with grasses and herbs. Descending from them are valleys or nullahs leaving grass-covered ridges between

¹ See 'Ornithology of Travancore and Cochin' (J.B.N.H.S., xxxvii, pp. 827-28).

them. These nullahs—locally called *sholas*—are covered with a luxuriant forest growth, more or less evergreen above 4,500 ft. but mixed with an increasing proportion of deciduous species lower down. The undergrowth in the *sholas* is largely composed of *Strobilanthes*. Coffee, pepper and cardamoms are cultivated in the highest *sholas*.

The evergreen forest, confined to the Western Ghāts and the country immediately at their base, extends from the north of Sāgar to the south of Saklēshpūr (Manjarābād)—a belt from 6 to 14 miles wide. Foon (*Catophyllum wightianum*), Ebony (*Diospyros ebenum*), *Vateria mairā* and Hesiwē or wild jack (*Artocarpus hirsuta*) are some of its characteristic trees. Both here and in the mixed belt rattan brakes, cane palms and brackens abound, especially in dank hollows. East of this evergreen is a mixed or intermediate zone 10 to 45 miles wide extending from north of Sorāb to south of Gundlūpet. It consists of the finest timber producing forests and is bordered on the east with much sandalwood. It also comprises the best areca-nut and cardamom gardens and the coffee plantations of Koppa and Manjarābād. Its junction with the evergreen belt on the west is marked by splendid Nandi (*Lagerstroemia microcarpa*), Blackwood (*Dalbergia latifolia*), Teak (*Tectona grandis*), Satinwood (*Clitoroxylon swietenia*), Matti (*Terminalia tomentosa*), Ironwood (*Ayua*), *Bombax malabaricum* and *Ficus* of numerous species. A protrusion of the spiky Dhattay or Hebbidaru bamboo (*Bambusa arundinacea*) is met, while old forest clearings and the sites of abandoned coffee plantations are overgrown everywhere with impenetrable tangles of *Lantana*. This mixed or **intermediate zone** with its extremes at either end, referred to in the notes that follow as **moist-inter** and **dry-inter** belts depending upon the predominance in the mixture of evergreen or deciduous vegetation, is the richest area as regards bird life both in species and in numbers. It appears to be the climax zone for woodpeckers in particular.

The types of forest mostly met with in the Malnād area, according to Champion's classification, are the following:—

- Western Tropical Evergreen (Group 1A, type C3).
- Southern Tropical Semi-evergreen (Group 2A, type C2).
- Southern Tropical Moist Deciduous (Group 3A, type C1).

2. *Maidān*.—East of the tract under the direct influence of the Western Ghāts rainfall and humidity is the more open country known as Maidān which comprises the greater part of the State. It may be divided into several parts each taking its character from the means of water supply and the prevailing cultivation. In the north are level plains of black soil growing cotton and millets; tracts to the S and S-W are irrigated from channels drawn from the rivers and are covered with sugar-cane and rice fields. Those irrigated from bunded tanks have gardens of cocoanut and areca palms. The wide tracts of red soil in the east yield rāgi and other dry crops.

The stony and wide-spreading pasture grounds in the centre of the plateau are stretches of coarse scraggy grass relieved by shady groves of trees. Some of the trees characteristic of this region are



1. A Cardamom plantation with lofty evergreen natural shade trees. A favourite haunt of birds.



2. Dry, stony hills country — Chitaldrug environs.
Scrub patches inhabited by *Pycnonotus xantholaemus*.

Photos by

Salim Ali

jāmūn (*Eugenia jambolana*), bael (*Ægle marmelos*), ippé or mhowa (*Bassia latifolia*), *Pterocarpus santalinus*, tamarind (*Tamarindus indica*), wood-apple (*Feronia limonia*), mango (*Mangifera indica*), jack (*Artocarpus integrifolia*), babool (*Acacia arabica*), karanj (*Pongamia glabra*), sandalwood (*Santalum album*), cocoanut (*Cocos nucifera*), date (*Phoenix sylvestris* and *P. farinifera*), the last species particularly in the centre and east. The bare, rocky hill ranges in this zone as well as extensive areas in the plains are covered with small trees and twiners of various species forming scrub-and-bush jungle. *Dodonaea viscosa*, *Zizyphus ænoplia* and *jujuba*, *Cassia auriculata*, *Phyllanthus reticulatus* and *Randia* spp. being some of the more prominent. Of the twiners an unforgettable species for any one who has tried to retrieve a wounded bird from amongst its tangles is *Pterolobium indicum*, the vicious recurved thorns of which tear out bits of ones clothing with flesh attached. It is aptly named 'badabakku' in Canarese, meaning 'Flesh-puller'.

Lantana is again plentiful everywhere. Apparently until quite recently large areas were laid waste by *Opuntia* cactus (prickly pear) which has died down since the introduction of the cochineal insect *Coccus cacti*. Its disappearance has evidently not proved an unmixed blessing. The brakes of *Opuntia* are said to have afforded protection from browsing animals to all naturally regenerated seedlings, especially sandal, while its fruit was largely eaten in times of scarcity by the poor as well as by numerous animals and birds. *Lantana* tangles are also said to be beneficial in fostering sandalwood seedlings in the same way.

The forests in the Maidān region approximate largely to the following types of Champion:

- Southern Tropical Dry Deciduous (Group 4A, type C2).
- Southern Thorn (Group 5A).

ITINERARY.

- | | |
|------------------------|---|
| 6-13 November 1939 ... | Biligirirangan Hills, 3,000-5,500 ft.
—Mysore District (Honnametti, Attikān, Bedagūli, Dodsampagi, Bellāji). |
| 15-26 November ... | Bandipur, 3,300'—Mysore District
(Gūdalūr Ghāt, Hangala, Gūndlūpet, Maddūr, Gopalswāmi betta). |
| 27 Nov.-7 December ... | Antarsāntē, 2,500'—Mysore Dist. (Manch-gowdanhālli, Heggadevānkotē, Karāpūr, Bēgūr). |
| 8-11 December ... | Mysore—Mysore Dist. (Hūsūr, Māndya, Periapatna, Seringapatām, Krishnarājsāgar). |
| 12-18 December ... | Sātūr ca. 2,500'—Bangalore District
(Shimsha, Sivāsamūdrām, Devarbetta). |
| 19-30 December ... | Dodballāpūr, ca. 2,900'—Bangalore Dist.
(Māklidrūg, Thondēbhāvi, Nandidrūg (Kolār Dist.). |

31 Dec.-4 Jan. 1940	...	Nāmadachilumē, ca. 3,000'—Tūmkūr Dist. (Devārāyadrūg).
5-11 January	...	Mārikānivē (Vanivilāspūra) ca. 2,500'—Chitaldrūg Dist. (Vanivilās Sāgar, Jogimaradi, Hiriyūr).
12-18 January	...	Saklēshpūr, ca. 3,000'—Hassan Dist. (Kādāmanē Estate. Also Hebbalē in Coorg).
19-24 January	...	Kemmangūndi, Bābābūdan Hills, 4-5,000'—Kadūr Dist. (Jāgar Valley ca. 2,500').
25 Jan.-2 Feb.	...	Settihalli, ca. 2,500'—Shimoga Dist.
3-9 February	...	Agūmbē, ca. 2,000'—Shimoga Dist.
10-13 February	...	Jōg (Gersoppa), ca. 2,000'—Shimoga Dist.
20-25 February	...	Kolār Gold Fields—Kolār Dist.

A car at my disposal enabled me to scour large tracts of country, visit remote localities and collect over a much wider area around the camps than would otherwise have been possible. Thus it can reasonably be claimed that no important habitat types within the State escaped study.

It might be useful again to define the terms *Biotope* and *Facies* as used in the following pages. Biotope is the larger unit. For example by 'Evergreen biotope' I mean all the zone of luxuriant tropical vegetation brought about by, and under the influence of, the heavy rainfall and excessive humidity that occurs on the seaward faces of the south-western Ghāts lying directly in the path of the S-W Monsoon currents. A biotope is split up into several facies. For instance one frequently comes across patches in evergreen forest which are covered predominately with eeta bamboo (*Ochlandra travancorica*). These are referred to as 'eeta facies' of evergreen biotope, and so on. Again, there occur here and there patches in evergreen biotope which, owing to having been cleared in the past or due to some peculiarity in the composition of the soil, are covered largely by deciduous or semi-deciduous trees and vegetation and present a more or less deciduous aspect. Such patches are referred to in my notes as 'deciduous facies' of evergreen biotope. The terms 'zone' and 'belt' are employed rather loosely; they both mean more or less the same unit of area, except that by the term 'belt' I specifically have in mind that imaginary 'seam' of diffusion or transition which joins the deciduous biotope with the intermediate zone on the one hand, and the intermediate zone with evergreen biotope on the other.

Just as a genus may contain several species, so may a biotope contain several facies. The latter may, for convenience, be further subdivided in the same way as we subdivide bird species into races. On the other hand biotopes may be raised into higher and higher groups just as genera rise into families, sub-orders and orders.

In the course of this survey special attention was paid to habitats and to the aetiology of local distributions. The following lists are based on data collected and notes made in the field. To avoid repetition, field notes on habits, etc. of birds are only given



The Gersoppa or Jog Falls, Sagar Dist.

Cliffs behind and flanking the falls provide breeding sites to countless Rock Pigeons (*Columba livia*) and Alpine Swifts (*Micropus melba bakeri*). They are also the scene of the legendary granaries of birds.

Photo by

Z. Futebally

where they were omitted or where they supplement my previous paper on Travancore and Cochin birds.¹

RESIDENT BIRDS CHIEFLY RESTRICTED TO EVERGREEN BIOTOPE :

Dendrocitta leucogastra

(Cardamom sholas and overgrown rubber plantations)

Machlolophus xanthogenys

(Typical habitat Group 3A, type C₁. Lofty trees in cardamom plantations. Bamboo facies as in the Jāgar Valley, Bābā-būdan Hills).

Sitta frontalis

(Sholas and bamboo facies. Also in the mixed intermediate zone)

Garrulax delesserti

Rhopocichla atriceps

Brachypteryx major

(Sholas at ca. 4,000 ft.)

Oreocincla dauma

(Sholas)

Muscicapula pallipes

(In undergrowth of seedlings).

Eumiyas albicaudata

(Sholas above ca. 3,500 ft.)

Ochromela nigrorufa

(Sholas : amongst undergrowth of thin upright seedlings or eeta.

Also cane brakes and cardamom plants in dank ravines.

Usually above ca. 3,500 ft.)

Irena puella

(On the plateau and up to the highest sholas)

Cinnyris minima

(Plateau and up to the highest sholas)

Arachnothera longirostris

(Partial to moist-inter belt, Group 3A, C₁ and 2A, C₃)

Dinopium javanense

(Preferential habitat: moist-inter belt)

Chrysocolaptes guttacristatus

(Moist-inter belt)

Macropicus javensis

(Moist-inter belt)

Vivia innominatus

(Moist-inter belt with bamboo)

Xantholoema rubricapilla

(Moist-inter belt)

Psittacula columboides

(Also enters intermediate zone)

¹ 'The Ornithology of Travancore and Cochin' commencing in vol. xxxvii, No. 4 *Journal of the Bombay Natural History Society* (1935).

- Tockus griseus*
(Sholas)
- Harpactes fasciatus*
(Sholas and moist-inter belt)
- Chaetura giganteus*
(Grassy hilltops and forest clearings)
- Indicapus sylvaticus*
(Grassy hilltops and forest clearings)
- Dendrophassa pompadora*
(Also in moist-inter belt)
- Ducula badia*
(Also in moist-inter belt)
- Chalcophaps indica*
(Also in moist-inter belt and intermediate zone)
- Columba elphinstonii*
(Partial to moist-inter belt)

RESIDENT BIRDS CHIEFLY RESTRICTED TO THE MIXED INTERMEDIATE
(OR TRANSITION ZONE) BETWEEN EVERGREEN AND DECIDUOUS
BIOTOPES.

- Pericrocotus flammeus*
(Extending sparingly into fringe of both extremes)
- Graculus religiosa*
(Wandering freely into fringe of either extreme)
- Hemicircus canente*
(Bamboo facies, and about edge of coffee plantations up to ca.
3,000')
- Chrysocolaptes guttacristatus*
(Partial to moist-inter belt)
- Thereiceryx viridis*
(Also in evergreen)
- Zosterops palpebrosa*
(Also in evergreen)
- Coryllis vernalis*
(Also wandering into both extremes)
- Bucia athertoni*
(Wanders across into both extremes)
- Gallus sonnerati*
(More or less throughout the evergreen at one extreme and
down into secondary jungle and scrub-and-bush facies at the
other)

RESIDENT BIRDS CHIEFLY RESTRICTED TO DECIDUOUS BIOTOPE.

- Sitta castanea*
- Dumetia hypertyhra*
(Also in deciduous facies of evergreen biotope, as in Biligiriran-
gan Hills)

Ægithina tiphia

(Also in deciduous facies of evergreen biotope, as at Agūmbē and Saklēshpūr)

Alseonax latirostris

(Light open forest and teak plantations, with bamboo and undergrowth of grass and sparse scrub)

*Leucocirca aureola**Lanius vittatus*

[Typical habitat: midway between that of *Lanius lahtora* (semi-desert) and that of *Lanius schach* (fairly wooded country)]

Tephrodornis pondicerianus

(Scrub and secondary jungle)

Pericrocotus peregrinus

(Scrub and secondary jungle)

Lalage sykesi

(Scrub and secondary jungle)

Graucalus javensis

(Scrub and secondary jungle. Occasionally wandering into intermediate zone)

Orthotomus sutorius

(Scrub-and-bush country)

Franklinia gracilis

(Tall coarse grass in secondary jungle)

Sturnia malabarica

(Teak and other forest plantations. Scrub and secondary jungle)

Temenuchus pagodarum

(Scrub and secondary jungle. Near human habitations)

Æthiopsar fuscus

(Patchy. Sporadically in intermediate zone also)

Ploceus philippinus

(Lightly wooded country about cultivation. Seasonal local migrant)

Uroloncha striata

(Scrub and lightly wooded country about cultivation)

Uroloncha malabarica

(Scrub and lightly wooded country about cultivation)

Uroloncha punctulata

(Scrub and lightly wooded country about cultivation)

Amandava amandava

(Reeds and rushes by swamps and *jheels*)

Gymnorhis xanthocollis

(Light secondary jungle. Near cultivation and human habitations. Seasonal local migrant)

Eremopterix grisea

(Open, dry sparse scrub and fallow land)

Ammomanes phoenicurus

(Open, dry sparse scrub and fallow land)

Cinnyris asiatica

(Secondary jungle, wooded cultivated country, gardens and compounds)

Cinnyris zeylonica

(Scrub and light secondary jungle. Dry, cultivated country with tamarind, cactus and babool trees)

Picus xanthopygaeus

(Secondary jungle. Forest plantations)

Dryobates mahrattensis

(Secondary jungle. Entering dry-inter belt)

Dryobates hardwickii

(Secondary jungle. Thin tree and bush country)

Micropternus brachyurus

(Secondary jungle, especially bamboo facies. Teak and other forest plantations)

Brachypternus benghalensis

(Lightly wooded country, gardens and compounds. Groves of trees about cultivation)

Xantholoema haemacephala

(Wooded country. Groves of trees about towns, villages and cultivation)

Clamator jacobinus

(Wooded country. Groves of trees about towns, villages and cultivation)

Eudynamis scolopaceus

(Wooded country. Groves of trees about towns, villages and cultivation)

Rhopodytes viridirostris

(Thin secondary jungle. Scrub-and-bush facies)

Centropus sinensis

(Thin secondary jungle. Scrub-and-bush facies. Usually about cultivation)

Psittacula krameri

(Fairly wooded country, usually about cultivation)

Psittacula cyanocephala

(Fairly wooded country, usually about cultivation. Also enters dry-inter belt)

Coracias benghalensis

(Open, lightly wooded country and cultivation)

Merops orientalis

(Scrub-and-bush facies. Open cultivated country)

Merops leschenaulti

(Wooded country in dry-inter belt)

Alcedo atthis

(Also throughout intermediate zone)

Halcyon smyrnensis

(Tanks and ponds. Also light secondary jungle)

Tockus birostris

(Secondary jungle. Wooded country about cultivation)

Upupa epops

(Extends decreasingly across intermediate zone)

Micropus affinis

Hemiprocne coronata

(Secondary jungle. About forest clearings for cultivation.
Also in dry-inter belt)

Caprimulgus indicus

(Teak plantations. Bamboo facies)

Caprimulgus asiaticus

(Sparse scrub and fallow land)

Strix ocellata

(Groves of densely foliated tamarind and similar trees in the
neighbourhood of villages and cultivation)

Bubo bubo

(Ravines and boulder hillocks in secondary jungle. Groves of
large trees about villages and cultivation)

Athene brama

(Groves of trees about human habitations and cultivation)

Neophron percnopterus

(About human habitations. Occasionally also in intermediate
zone)

Circaetus ferox

Butastur teesa

(Open secondary jungle. Near cultivation)

Haliastur indus

(About human habitations and water)

Milvus govinda

(About human habitations)

Elanus caeruleus

(Secondary and scrub jungle)

Astur badius

(Wooded country and groves of trees, frequently about villages
and cultivation)

Crocopus phoenicopterus

(Also in dry-inter belt)

Muscadivora aenea

(Also decreasingly through dry-inter belt into intermediate zone)

Streptopelia chinensis

(Wooded country. Also in dry-inter belt)

Streptopelia senegalensis

(Dry, open and less wooded country than above)

Streptopelia decaocto

(Dry, open, lightly wooded country)

Ænopoelia tranquebarica

(Dry, open, lightly wooded country and cultivation)

Pterocles indicus

(Dry, stony, sparsely scrubbed and broken country)

Pterocles exustus

(Dry, stony semi-desert)

Pavo cristatus

(Secondary jungle with bamboo, near streams. Occasionally in dry-inter belt)

Galloperdix spadicea

(Scrub-and-bush facies. Broken hilly country. Extends into dry-inter belt)

Coturnix coromandelica

(Grassland. Cultivation)

Perdicula asiatica

(Flat, stony, sparsely grass covered scrub-and-bush)

Perdicula argoondah

(Scrub-and-bush, more stony than above, and laterite soil)

Francolinus pondicerianus

(Flat, dry scrub-and-bush about cultivation)

Turnix suscitator

(Flat, scraggy grass-covered scrub-and-bush, usually bordering cultivation)

Burhinus oedicnemus

(Light secondary bamboo and scrub jungle, interspersed with open spaces)

Lobipluvia malabarica

(Dry, open, sparse scrub and fallow land about cultivation)

*Summary of the more important scientific results of the Mysore
Bird Survey detailed in this paper.*

1. Careful collection of ecological data has led to an attempt to connect up immediate environment and life conditions with the distribution of resident bird species, and to fix provisional Habitat Types.

2. The question of plumages of the races of the Yellow-cheeked Tit (*Machlolophus xanthogenys*) is settled.

3. The 3 races of the Scimitar Babbler *Pomatorhinus horsfieldi*, namely *travancoreensis*, *horsfieldi* and *maderaspatensis* occur in South India with a parallel distribution in the Western Ghāts, Central Plateau and Eastern Ghāts respectively.

4. The known distribution of the Yellow-breasted Babbler (*Mixornis gularis rubricapilla*) is greatly extended by its unexpected discovery at Antarsāntē.

5. The habitat type of the scarce and patchily distributed Yellow-throated Bulbul (*Pycnonotus xantholaemus*) is indicated.

6. The range of the Rufous-bellied Shortwing (*Brachypteryx major major*) of the Nilgiris, is considerably extended to the north by its discovery in the Bābābūdan Hills.

7. The winter range of the White-browed Blue Flycatcher (*Muscicapula s. superciliaris*) is greatly extended southward by a specimen from Tūmkūr District.

8. The west coast range of the Hair-crested Drongo (*Chibia hottentotta*) from Mahāblēshwar to Travancore is extended considerably inland by specimens from Tūmkūr District. This form is smaller than the northern (typical) race and has recently been separated as *Chibia hottentotta londae* Koelz.

9. Mysore can now be added to the ascertained range of *Franklinia gracilis albogularis*.

10. *Phylloscopus affinis*, *P. magnirostris* and *P. occipitalis* are recorded for the first time.

11. The long pending question of what the female of *Sturnia malabarica blythii* is like is settled.

12. Seasonal local movements of the Baya (*Ploceus philippinus*) here as in Bahāwalpūr seem largely controlled by the incidence of paddy cultivation.

13. From the local distribution of the 2 species of Bush-Lark it is suggested that *Mirafra erythroptera*, occurring on laterite soil, may, on closer study, prove to be merely an ecological race of *M. affinis* found on normal brownish coloured soil, or vice versa.

14. The habitat type and biological associations of the Spotted Piculet (*Vivia innominatus*) are defined.

15. The 'hepatic' plumage of *Cacomantis merulinus passerinus* is shown to moult to 'hepatic' plumage.

16. Males of the Rose-ringed Paroquet (*Psittacula krameri manillensis*) evidently breed even while in immature female-like plumage.

17. The southern race of *Coryllis vernalis*, viz. *rubropygialis*, cannot be maintained.

18. The richly coloured form of the Rufous Turtle-Dove, now proved to be the resident race of peninsular India, is named *Streptopelia orientalis erythrocephala* (Bonaparte).

19. *Gallus sonnerati* is evidently polygamous in a particular way, and apparently breeds throughout the year.

20. The Rock Bush-Quail found on red laterite soil is apathetically coloured and is described as *Perdica argoondah salimalii* subsp. nov.

21. Confirmation is provided that one of the winter quarters of the European Little Ringed Plover (*Charadrius dubius curonicus*) is Mysore.

22. Mating of Alpine Swifts (*Microtus melba*) takes place in mid-air. A possible reason for their gradually flying higher and higher after sunset is suggested.

SYSTEMATIC LIST.

Corvus macrorhynchus culminatus Sykes. The Southern Jungle Crow.

Specimens collected: 535♂ 3-1-40 Nāmadachilumē (3,000'); 838 ♀, 839 ♂ 5-2-40 Augumbē (2,500'); Biligirirangan Hills: M₄(H) ♀ 7-5-34, M₄₂(H) ♂ 14-5-34¹ ca. 5,000'.

Noted: Chamarājanagar, Bandipūr, Mysore City and environs, Saklēshpūr, Kolār Gold Fields and elsewhere.

¹ M denotes collected by R. C. Morris. He had two series, G and H. The letter in brackets refers to these.

[Measurements :

	Bill	Wing	Tail
2 ♂♂ ad.	61	304-318	172-182 mm.
2 ♂♂ imm.	59-65	307-313	172-178 mm.
1 ♀ ad.	63	313	184 mm.
1 ♀ imm.	54	286	158 mm.

The principle on which I divided these crows was given in the Eastern Ghâts Survey (*J.B.N.H.S.*, xxxv, 511-513) and these specimens agree with that. All have the base of the nape feathers dusky.—H. W.]

Fairly common about outlying habitations. On the whole this is the common crow of Mysore State. Even in Mysore City it is more abundant than the House-Crow.

In the specimen of 3 January the testes measured 10×5 mm., but no further information as regards breeding was procured by the Survey.

Corvus splendens splendens Vieill. The Common Indian House-Crow.

Specimens collected : 505 ♀ 29-12-39 Thondēbhāvi (2,500').

Elsewhere noted : Chamarājanagar, Mysore City, Antarsāntē, Kolār Gold Fields.

Absent at Bandipūr, Saklēshpur, Biligirirangan Hills (3-5,000 ft.).

[Measurements :

	Bill	Wing	Tail
1 ♀ ad.	47.5	284	173 mm.—H. W.]

Not common by its usual standards. Everywhere less abundant than the Jungle Crow.

Dendrocitta vagabunda vernayi Kinnear & Whistler. The Eastern Ghâts Tree-Pie.

Specimens collected : 348 ♀, 349 ♀ 15-12-39 Devarbetta (ca. 3,000'); 439 ♀, 445 ♀ 24-12-39, 495 ♂ 28-12-39 Dodballapūr (ca. 2,900'); 519 ♀ 1-1-40 Nāmadachilumē (3,000'); 633 ♀ 15-1-40 Saklēshpur (3,000'); *Biligirirangan Hills* : M19(H) ♂ 4-3-34 (4,000 Dodsampagi); M115(H) o? juv. 25-5-34 (4,000' Edbūthi); M29(G) ♂ 13-7-34. M46(G) o? 17-7-34, M52(G) ♂ 15-7-34. (3,000' Udahatti, Eastern base of hills); M42(G) ♀ 23-9-34 (Satyamangala 2,000').

Elsewhere noted : Bedagūli, Bandipūr, Maddūr, Settihalli.

[Measurements :

	Bill	Wing	Tail
4 ♂♂ ad.	30-34	148-150	201-236 mm.
7 ♀♀ ad.	28.5-32.5	137-152	188-225 mm.

The Indian Tree-Pie is a bird that shows a good deal of individual variation in size and colour and it is also rather susceptible to wear and bleaching. There is intergradation between the races as is to be expected with a bird that has very general distribution in India. The opportunity of examining a good series of new skins from southern India has therefore been very welcome to me as affording a means of re-checking the validity of the race *vernayi*. A careful comparison of these specimens with an equally good series from N-E India has satisfied me afresh that *vernayi* is a good race. In a series it is definitely smaller and paler as originally stated. The smallness of size is also emphasized in the comparative weakness of the beak and the narrowness of the central tail feathers. The difference in colour with the neighbouring Malabar race *D. v. parvula* is also very marked.—H. W.]

Fairly common in deciduous forest—usually in the mixed hunting parties. Gonads of the Survey specimens (November to mid-January) were quiescent.

Dendrocitta leucogastra Gould. The Southern Tree-Pie.

Specimens collected : 666 ♂ 17-1-40 Kādāmanē Estate (3,200'); 855 ♀ 8-2-40 Agūmbē (2,000').

Elsewhere noted : Saklēshpur, Bābābūdan Hills (ca. 4,000'), Settihalli.

[Measurements :

	Bill	Wing	Tail
1 ♂	38	141	280 mm.
1 ♀	37	148	291 mm.—H. W.]

Inseparable from evergreen biotope. Met with sparingly—usually pairs—among shade trees in cardamom *sholas* and ravines, and dense lofty forest. Always very wild.

Parus major stupae Koelz. The Indian Grey Tit.

Specimens collected : 80 ♂ 15-11-39 Bandipur (3,300'); 402 ♀ 20-12-39, 463 ♂, 464 ♂ 26-12-39, 471 ♂ 481 ♂ 27-12-39 Doddballapur (2,900'). *Biligirirangan Hills* : M94(G) o? juv. 26-7-34 (Udahatti 3,000') 18 o? 8-11-39. (3,000' Badagūli).

[Measurements :

	Bill	Wing	Tail
4 ♂ ♂	11-11.5	67-71	50-59 mm.
3 ♀ ♀	11.5	65-65.5	52-55 mm.

No. 402 is cross-billed, both mandibles being elongated (upper mandible from skull 13 mm.) the upper mandible passing to the left and the lower mandible to the right.

The juvenile obtained at Udahatti in the Biligirirangans has the upper parts washed faintly with green. The nuchal and cheek patches and the vent are faintly tinged with yellow.

In the Eastern Ghats Survey (*J.B.N.H.S.*, xxxv, 517) on the poor series of Ceylon birds then available to me I agreed with previous authors in keeping the resident Grey Tit of peninsular India with the Ceylon bird *Parus major mahrattarum*. Since then I have had the opportunity of examining a good series of 12 fresh specimens in the Ceylon Survey and there is no doubt that the island form is not the same as that of the mainland. As compared with true *mahrattarum* Indian birds are paler and brighter in colour; the white edging of the tertiaries is broader and the bill is not so heavy. —H. W.]

Not uncommon in light deciduous forest. Occasionally met with in the dry-inter zone and further towards evergreen, but I never saw it actually within that biotope.

The juvenile of 26 July would place the breeding season at about June.

Parus nuchalis Jerdon. The White-winged Black Tit.

Specimen : *Biligirirangan Hills* : M6(G) ♂ juv. 14-9-34 (2,000' Satyamangala).

[Measurements :

	Wing	Tail
1 ♂ juv.	65	44.5 mm.—H. W.]

Besides Jerdon's type 'from the Eastern Ghats west of Nellore' this specimen is the only one now in existence from South India, although one is said to have been obtained by a Dr. Stewart at Bangalore.

Unfortunately the Survey failed to come across this tit in spite of a very special look-out for it, and the species is obviously very rare in S. India. Satyamangala is dry deciduous country.

Machlolophus xanthogenys travancoreensis Kinnear & Whistler. The Travancore Yellow-cheeked Tit.

Specimens collected : 617 ♀ 13-1-40, 632 ♂ 14-1-40, 638 ♂, 639 ♀ 15-1-40 Sakleshpūr (3,000'); 678 ♀ 19-1-40 (4,500'), 694 ♀ 20-1-40 (2,500'), 695 ♂ 21-1-40 (4,500') Bababudan Hills; 783 ♀ 30-1-40 Settihalli (2,500').

[Measurements :

	Bill	Wing	Tail
3 ♂ ♂	13	76-77	55-58 mm.
5 ♀ ♀	12.5-13	72-76	53-57 mm.

These specimens belong, as might be expected from their localities which are in western Mysore, (Malnad), to the race *travancorensis* though in the slightly brighter, less saturated colour of the green upper parts and the yellow of the lower plumage they show the beginning of intergrading with the altogether brighter Central Indian race *aplonotus*. Nos. 638 and 695 are adult and first winter males with black crowns and black ventral stripes. No. 632 is a juvenile male which, allowing for the usual juvenile characteristics, is similar with a black crown and a black ventral stripe.

The five females (Nos. 617, 639, 678, 694, 783) all have the crown and eyestripe and the ventral stripe dull olive green, that is to say they belong to phase (2) of my account of the plumages of this group (Central India Survey, *J.B.N.H.S.*, xli, p. 85). Unfortunately this resume has been rendered valueless by the accidental transposition of the names *M. x. aplonotus* and *M. x. travancorensis* in the printed text. That this phase is a dimorphism and not a question of age is shown by No. 617 which is in the post-nuptial moult (which takes place in December-January in this late breeding species); the crown and ventral stripe are replacing old olivegreen feathers with new olive-green feathers. No. 694 is also a particularly valuable specimen as it is just finishing the post-juvinal moult and retains sufficient juvenile feathers on the crown to show that it is replacing a dull black crown with a dull olive-green crown. This clears up the difficulty to which I have drawn attention in the Travancore Survey (*J.B.N.H.S.*, xxxviii, p. 66) of knowing whether the black-crowned juveniles can turn into green-crowned adults.

Once again therefore I will summarise the plumages of this difficult species with the proviso that I have seen no juvenile female of *aplonotus* but assume its plumage by analogy. In all cases the colour of the eyestripe follows that of the crown.

Machlolophus xanthogenys xanthogenys. Adult male and female alike. Crown black; ventral stripe black. Juveniles alike and similar to the adults.

Machlolophus xanthogenys aplonotus. Adult male and female not alike. Male: crown black; ventral stripe black. Female: crown black; ventral stripe dull olive-green. Juveniles not alike but resembling their respective adults. (Note. I have seen birds indistinguishable from adult males marked female, so possibly the female is dimorphic but this should be verified).

Machlolophus xanthogenys travancorensis. Adult male and female not alike. Male: crown black; ventral stripe black. Females polymorphic: phase (1) similar to adult male (I have seen at least 4 skins similar to the adult male with black crown and black ventral stripe marked female, so this phase may provisionally be accepted though I have seen no recently collected skins of this type to verify such sexing); phase (2) as in *aplonotus* crown black; ventral stripe dull olive-green (here again I should like fresh verification); phase (3) crown dull olive-green; ventral stripe dull olive-green.

Juveniles not alike: male similar to the adult with black crown and black ventral stripe; female crown black and ventral stripe dull olive-green.—H. W.]

The Yellow-cheeked Tit was met with only in evergreen biotope; small parties hunting insects among the foliage of lofty trees such as in cardamom *sholas*, frequently in the mixed hunting parties. It was also partial to bamboo facies as in the Jāgar Valley.

***Sitta castanea castanea* Lesson. The Chestnut-bellied Nuthatch.**

Specimens collected: 81 ♂ 17-11-39 Bandipūr (3,300'); 191 ♂ 28-11-39, 276 ♀ 5-12-39 Antarsāntē (2,500'). *Biligirirangan Hills*: 14 ♂ 8-11-39 (3,000 Bedagūli); M22(G) ♂ 12-7-34, M85(G) ♀ 25-7-34 (3,000' Udahatti); M26(G) ♀ 20-9-34 (2,000' Satyamangala).

[Measurements :

	Bill	Wing	Tail
4 ♂ ♂	20-21	76-82	39-42 mm.
3 ♀ ♀	18.5-20	77-78.5	38-41.5 mm.—H. W.]

Pairs and family parties of 3 to 5 in deciduous forest, usually in the itinerant hunting parties of small insectivorous birds. Utters a mousy, quick-repeated *chip..chip..chip*.

Sitta frontalis frontalis Swainson. The Velvet-fronted Nuthatch.

Specimens collected: 354 ♂? 15-12-39 Devarbetta (3,000'); 738 ♀ 26-1-40, 781 ♀ 30-1-40 Settihalli (2,500'). *Biligirirangan Hills*: ♂♂ 22-12-32 (5,000' Honnametti); 5 ♂ 6-11-39, 15 ♂ 8-11-39 (4,000' Bedagūli); M59(H) ♂? 24-4-34, M26(H) ♂, M27(H) ♀ 9-5-34, M1(H) ♂ 7-5-34 (4,000'); M32(H) ♂? juv. 10-5-34, M15(G) ♂ 16-10-34 (5,000').

Elsewhere noted: Bandipūr, Karāpūr, Saklēshpūr, Jāgar Valley and Bābā-būdan Hills (2-4,500').

[Measurements:]

	Bill	Wing	Tail
7 ♂♂	15-16.5	75-80	39-45.5 mm.
5 ♀♀	15.5-17	73-75.5	38-42 mm.—H. W.]

Common. Frequents evergreen *sholas*, creeping up, along and around the moss- and lichen-covered branches. Usually met with as a member of the mixed hunting parties of which *Culicicapa*, *Phylloscopus occipitalis* and *Pericrocotus flammeus* are some of the most constant components.

It is also common in the intermediate zone particularly in the moist-inter belt, in patches where plenty of bamboo clumps occur amongst the scattered trees. In dry-inter forest I occasionally found it in the same patch as the Chestnut-bellied Nuthatch though it is essentially a bird of evergreen biotope while *castanea* is more or less restricted to the deciduous.

(To be continued)

OBSERVATIONS ON INDIAN DUCKWEEDS, *LEMNACEAE*

BY

CHARLES McCANN, F.L.S.

(With nine plates and one text-figure).

INTRODUCTION

The Indian *Lemnaceae*, though they offer no particular problem of their own, present to the research-worker a large number of possibilities, for their study raises many interrogation marks common to the order as a whole. The usually small size of the plants—the smallest Phanerogams in the world—with naturally minute and obscure floral parts is enough to cool the enthusiasm of all but the keenest botanists. Further, the comparatively short flowering period of some of the species in a particular locality, makes it necessary that the plants be collected at the *right* time. This brief periodicity probably explains the oft-repeated statement 'rarely flowering' found in so many botanical works. The difficulties of the botanist are further increased when he comes to determining the diagnostic characters. The size of the plants is so restricted and the form so variable, particularly those of the genus *Lemna*, that the botanist is immediately faced with the difficulty of separating the species. Numerous species have been described from various quarters of the globe, many of which were perhaps never obtained in flower, so that the specificity rests merely on the description of the vegetative organs, an admittedly very variable set of characters.

When I undertook the study of the order some years ago, I had no idea of the difficulties involved. A preliminary survey of the Bombay material soon convinced me that the local collections could not lead me very far on the way to elucidating the numerous problems raised. Accordingly, I issued an appeal in the Society's *Journal* for material from various localities in India and Burma. The response was, unfortunately, not very encouraging. Nevertheless, I feel that some effort has to be made towards clearing up the present confusion. For example, T. Cooke records three species of *Lemna* for the Bombay Presidency, viz., *L. paucicostata*, *L. trisulca*, and *L. polyrrhiza* (= *Spirodela polyrrhiza*). So far, I have failed to obtain the first two. Cooke had not seen these two species, but has evidently recorded them on the authority of others. There is no doubt that Cooke must have seen species of *Lemna* in the Presidency, but what were those species?

This paper is published with a view to place on record the many observations I have made in the course of my study, both in the field, and in preserved material. The bulk of this material was obtained in Salsette Island and the notes are chiefly from living plants kept under observation in the field and in aquaria.

The literature at my disposal is meagre, for the bulk of it consists of passages copied from one flora to another, and mostly extracts from Hegelmaier's valuable monograph *Die Lemnaceen* (1868). Hegelmaier's excellent figures are familiar to most students of botany for they have been repeated in almost every textbook.

GENERAL REMARKS ON THE ORDER.

The Order, *Lemnaceae*, is composed of three small genera, *Lemna*, *Spirodela*, and *Wolffia*, all small floating aquatic plants, having a cosmopolitan distribution. The general appearance of *Wolffia* immediately separates it from the other two genera. *Spirodela* is readily distinguished from *Lemna* by its numerous roots, *Lemna* possessing but a single root. Of the three genera *Lemna* is perhaps the most difficult of dissolving into its respective species.

The *Lemnaceae* are one of the least understood orders of the flowering plants. The reasons are the usually small size of the plants and their floral parts; the comparatively few stable specific characters; the difficulty of obtaining the plants at the right period; and the great variability of the vegetative regions due to environment and age.

Fronds.—The true nature of the frond is a matter of much discussion and difference of opinion. Some authors consider it foliar, others axial, while yet others seek a middle path and refer to it as partly foliar and partly axial—axial at the base, and foliar in the distal region. The last view is perhaps the correct one, but needs elucidation. In my opinion the axial region is confined to the narrow thread-like structure which is fused to the ventral portion of the frond and which gives rise to new fronds and flowers, and the roots. It is clearly visible in both *Lemna* and *Spirodela*, but in *Wolffia* it is reduced to a minute structure. The frond I consider as a foliar structure 'superimposed' on the axis. Portions of the axis are capable of giving rise to new plants, but a fragment of the foliar region does not do so. The fusion of the axial and foliar expansions is so complete that they cannot be separated. Another view is that the foliar region is merely an expansion of the axis itself. The axial 'thread' gives rise to short branches and new fronds and the floral structures or the resting bud (in *Spirodela* only).

Resting buds.—Regarding the propagation of the *Lemnaceae*, Hooker writes, 'propagated by budding or by hibernating bulbils, rarely by seed.' During the period of vegetative activity the species of all three genera are propagated by budding, but only in the genus *Spirodela* have I found actual *resting buds*, highly charged with reserve material. In this genus I have noticed that the flowers are not so profusely produced as in *Lemna* and *Wolffia*.

Roots.—Of the three genera *Wolffia* is rootless; *Lemna* has but a single root; and *Spirodela* has multiple roots. The roots hang down stiffly and serve mainly as a 'drag anchor' preventing the plants from turning over and from drifting about too readily.

In *Spirodela*, I have observed that the roots are 'equally' suited for a terrestrial habit, i.e. when the plants are stranded on slush, the roots develop to a remarkable degree and penetrate deeply into the substratum. Under such conditions the plants appear larger and more vigorous than purely aquatic specimens. Specimens disturbed from their natural habitat soon lose their roots, but may develop new ones. In specimens of *Lemna* growing in thin slush extremely long roots are likewise developed.

Flower or inflorescence (?).—A comparison of the characters of the order and genera as given in various works appears misleading, and indicates that authors are often undecided as to whether the floral structures constitute a single flower—consisting of both male and female elements, or an inflorescence composed of separate male and female flowers enclosed in a common spathe. Being closely allied to the *Araceae* I consider the whole as an inflorescence, composed of one female and two male elements in *Lemna* and *Spirodela*, and of one female and one male element in *Wolffia*. The inflorescence arises between two marginal flaps forming a 'pocket' near the basal portion of the frond; in *Wolffia* in a medium cup-like cavity.

Spathe.—The spathe, which in *Lemna* and *Spirodela* arises from the ventral surface of the 'pocket' is totally absent in *Wolffia*. In *Lemna* it is composed of a single or double-layered membrane, but it is always two-layered in *Spirodela*.

Male flowers.—The male flowers are reduced to just two short stamens in *Lemna* and *Spirodela*, and to one in *Wolffia*. The filament is thick and cellular and is surmounted by a bilobed anther (single in *Wolffia*). When two stamens are present, one rises above the frond and matures; this is followed by the maturation of the stigma, and finally by that of the second stamen.

Pollen.—The pollen is spherical and echinate. Pollen tubes of considerable length are developed rapidly, and the germination is distinctly visible under the microscope. In colour the pollen is a translucent white. The grains adhere and 'overflow' the anther cells.

Female flowers.—The female flower is reduced to an ovary and stigma.

Ovules.—The floras give the number of ovules as '1 to 7', but in no case have I observed more than two ovules—the ovule is solitary¹ in *Lemna* and *Wolffia*, and twin in *Spirodela*. Much stress has been laid on the position of the ovule. Some species are supposedly *anatropous*, others *orthotropous*, and yet again others are variations of the two. According to my observations with living plants, I find that the seed passes through these tropic movements at different stages of its development. The ovule is at first erect. After fertilization it commences to assume a horizontal position; in which position it remains for a considerable time, till the seed is nearing maturity. It now gradually moves back from the horizontal to the erect position. Thus it is clear that

¹ Vide Hegelmaier, *L. gibba* has 1 to 6 ovules.

the ovule as it matures to a seed is successively orthotropous, amphitropous, anatropous, and finally orthotropous! The 'tropic' position of the seed is therefore dependent on age, and is accordingly of no systematic value.

Seed.—The seed when mature separates from the seed coat and sinks to the bottom where it remains buried till the next vegetative season, or may refloat to the surface if the water is perennial. In *Lemna* the parent plant dies soon after. In *Wolffia* the entire plant containing the seed becomes yellow, dies, and sinks to the bottom where the seed is eventually freed by decomposition. In the dry weather the seeds shrink somewhat. At the next vegetative period the seeds are washed out of the mud by the rains and float to the surface where they soon germinate. The seeds of *Wolffia* rise to the surface again after a short period of rest when water is perennial.

Fertilization.—Cross-fertilization and self-fertilization are both provided for. As already indicated (in *Lemna*) one stamen matures before the stigma and then the second stamen. As the plants drift among themselves neighbouring stigmas and anthers come into contact. Should fertilization not be effected in this way, the second anther is matured in such a position as to effect self-fertilization. Apart from cross-fertilization by contact, there are usually attendant on *Lemnaceae* a large number of small weevils which feed on the fronds and act as pollen carriers. As far as I am aware wind and water play no direct part at all in pollination. This double provision for ensuring fertilization I have also observed in some of the members of the closely allied order, *Araceae*.

Development.—Seeds kept dry from the previous year germinated in from five to six days (others took a longer time) after being placed in water at the appropriate period. At first they floated irregularly, became gradually turgid and then assumed the erect position. A green 'globule' now appeared at the top of the seed, the plumule. No radicle was observed at this stage. Soon after the plumule there appeared the first frond. A few days later a second frond arose from the first and a single root made its appearance on the underside of each frond. During the formation of the two fronds the remains of the seed and the plumule remained attached, but the former was considerably shrivelled. A few days later the plumule died away and the frond led an independent existence. The only changes observed from now on was the enlargement of the fronds and the elongation of the roots. The above observations were made on the development of *Lemna* (see plate IV).

Seed dispersal.—Ridley¹, referring to seed dispersal in the *Lemnaceae* writes, 'The Lemnas owe their wide distribution to the transport of the whole plant by floods or rivers, or adhesion to the birds or batrachians, and are treated under those sections. They seem to produce seed but rarely. Ravn states that the testa of the seeds consist entirely of aëriferous tissue with intercellular spaces, as in the case of *Menyanthes* and *Schenzeria*, so that they

¹ The Dispersal of Plants throughout the World, p. 236.

may be dispersed also by the floating seeds, occasionally at any rate.' There is no doubt that the *Lemnaceae* are greatly assisted in their distribution by aquatic or semi-aquatic animals; and there are two periods when animal agents come most into play: firstly, when the habitat is drying, the seeds being carried in mud clods and then dispersed by the wind; secondly, when the monsoon bursts and the habitats begin to fill up with water, for this is the time when numerous aquatic animals of all kinds are looking for suitable breeding grounds and in their search go from pool to pool carrying away on their bodies seed from one locality to another. In *Spirodela* the resting buds are spread in the same way. As the *Lemnaceae* are plants that generally, if not always, inhabit still waters, rivers are of little importance as dispersal agents.

Pests.—On the fronds of *Lemna* and *Spirodela* I have found large numbers of tiny weevils (*Curculionidae*) which drill holes into the fronds, but without going right through. In time the fronds die off. This same beetle also acts as a pollen carrier. The beetle also lays its eggs in the tissues of the fronds.

Another insect always found on *Lemna* and *Spirodela* is a small moth, *Nymphula responsalis* Walker. The larvae of this moth make their cases of the fronds, and feed on them; but as the fronds remain green and the pupae spend their short lives in the same cases the larvae frequently do a lot of damage to the plants in the aquarium before the presence of the moth is detected.

Genus: LEMNA

Fronds.—The fronds of *Lemna* may be either solitary or two to four attached to one another. Above the colour varies from dark to light green, but the undersurface is always paler.

Roots.—Solitary, only one being given off by each frond. Mr. Fischer, *Flora of the Presidency of Madras*, vol. iii, p. 1593, writes, 'with one or more capillary rootlets from the margins' or lower surface.' The plurality of the roots is explained by the fact that the author includes the genus *Spirodela* under *Lemna*, but marginal roots are unknown in the order! However, I may offer an explanation for this statement. I have frequently observed a stiff filiform alga parasitic on the margins of the fronds of *Lemna*.

Resting buds.—Not observed in any of the species examined.

Flowers.—Under suitable conditions flowers are freely produced. Male flowers are reduced to two stamens, one maturing before the stigma and the second soon after the stigma. Cooke, *Flora of the Bombay Presidency*, vol. ii, p. 831, with regard to the male flowers says, under the generic characters, 'Stamens solitary'; yet under the specific characters he states, 'Stamens 2.'! Actually there are two stamens. Pollen echinate, producing long pollen tubes. The stigma when mature produces a droplet of 'water' which if removed is replaced by another. Evidently this is an aid in fertilization.

Seeds.—Solitary²: when mature it falls out of its envelope and sinks. The frond dies after seeding.

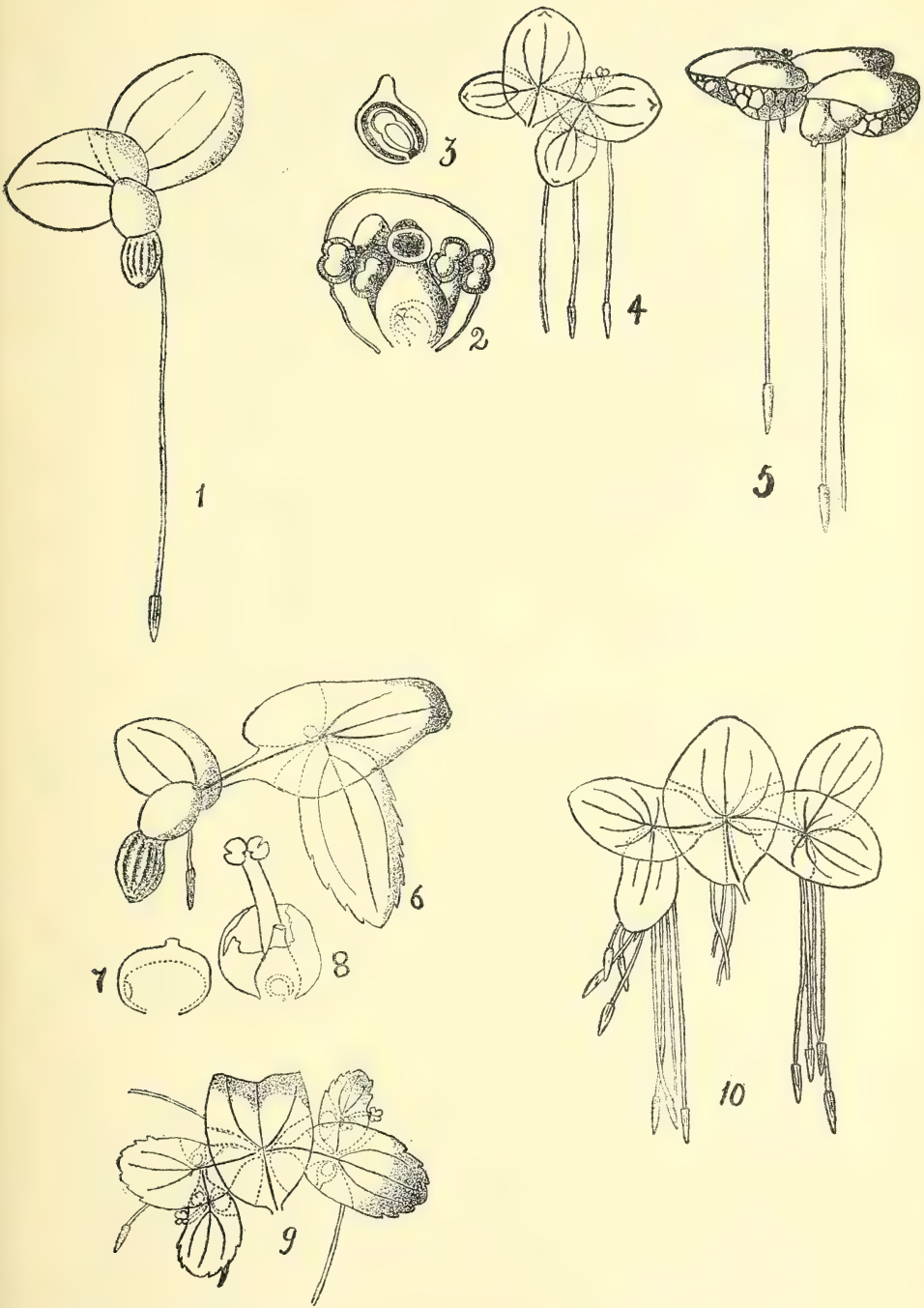
Dispersal.—As in the order.

Vernacular name.—*Pacha* in Malayalam (This name, which merely means 'green', is probably given to all *Lemnaceae*).

Medicinal uses.—Mixed with other ingredients *Lemna*, *Spirodela*, and perhaps also *Wolffia* are administered in cases of haemorrhagic loss during the menstrual life. Mixed with pepper they are applied to the eyes in cases of typhoid when the patient is unconscious.

¹ Italics are mine.

² 1. to 6 in *L. gibba*, vide Hegelmaier.



Del. McCann after Hegelmaier.

McCann—Indian Duckweeds.

For explanation see end of article.

Lemna minor Linn. *Sp. Pl.* (1753) 976. (Pl. I fig. 1).

*Description*¹.—Fronds $\frac{1}{2}$ - $\frac{1}{4}$ in.² long, symmetrical, obovoid or oblong, nearly flat on both surfaces.³ Root-sheath not appendaged, cap obtuse.⁴ Spathe 2 lipped. Stamens 2 (each a male flower). Style long. Ovule solitary. Seed horizontal, hemianatropal⁵ albuminous.

Distribution.—Cosmopolitan.

Localities.—Burma; Thamaing Railway Station (L. P. Khanna 24-4-37 !); Kamayut, Rangoon (L. P. Khanna 10-8-36 !); Agri. Hort. Gardens, Rangoon (L. P. Khanna 24-4-37 !).

Note.—Hooker⁶ under *L. minor* writes, 'Kurz (*Journ. Linn. Soc.* xi', 266) thinks that *L. minor* does not occur in India proper.' Actually Kurz's statement quoted above refers to *L. gibba* and not to *L. minor*! Through some error this statement of Kurz's was transplanted. With regard to *L. minor*, Kurz, under 'habitat' writes, 'All over India and the Indian Archipelago, Bengal! flowers abundantly;' and he then enumerates the localities. Hegelmaier appears to have disregarded Kurz's localities and does not mention them under either *L. minor* or *L. paucicostata*. It seems possible that Hooker's mistatement led Cooke to exclude *L. minor* from his *Flora of the Bombay Presidency*, and Fischer from his *Madras Flora*.

Lemna paucicostata Hegelmaier, *Die Lemnaceen* (1868) 139, t. viii. (Pl. I, figs. 2, 3, 4).

*Description*⁸.—Fronds obovoid or oblong-obovoid, somewhat membranous, nearly flat on both surfaces, strongly asymmetrical with a sharp spine not reaching the margin; 3-nerved. Root-cap acute. Root-sheath broadly appendaged. Seed asymmetrical.⁹

Distribution.—Cosmopolitan tropical.

Localities.—INDIA: Victoria Gardens, Byculla, Bombay (D. S. Laud, 1936 !); BURMA.—Agri.-Hort. Gardens, Rangoon (L. P. Khanna 24-4-37 !).

Note.—A comparison of the figures on plates viii (*L. paucicostata*) and ix (*L. minor*) of Hegelmaier's monograph, of the entire plants shows that they are hardly separable, if at all.

Both the acuteness of the root-cap and the presence or absence of the appendage to the root-sheath are not good diagnostic characters, both are easily damaged. The thinness or thickness of fronds in *Lemna* is also an unreliable character as the fronds often vary in thickness according to the situation in which they are growing—thin in the shade, thick in bright sunlight. *L. gibba* is perhaps an exception.

Lemna Blatteri McCann nov. comb.

Lemna minima Blatter & Hallberg. *Journ. Ind. Bot.*, ii. (1921) 50.

*Description*¹⁰.—Fronds 2-5 mm. long or shorter asymmetrical obovate or obovate-oblong, or orbicular, pale green, upper side minutely tuberculate; young fronds sessile on the parent. Root solitary, strong, about 15 mm. long, cap acute. Stamens 2, filaments long filiform, anthers bilobed, lobes round; pollen irregular, roundish. Style short, stigma lacerate. Seed horizontal, hemianatropous,¹¹ oval.

¹ Description partly after Hooker.

² According to Hegelmaier 'slightly symmetrical'.

³ According to Hegelmaier 'keeled above with a small elevated spine. 3-nerved (seldom 4-5 nerved).'

⁴ Hegelmaier includes a variety with acute root-caps.

⁵ The position of the seed has been discussed.

⁶ *Flora of British India*, vol. vi, 556.

⁷ *per errorem* xi, it should be ix.

⁸ Description after Hegelmaier.

⁹ Hooker: 'erect, orthotropous'. The position of the ovule has been discussed.

¹⁰ Description after Blatter & Hallberg.

¹¹ The position of the ovule has been discussed.

Localities: Achalgar, Mt. Abu, 1300 m. (Blatter).

Note.—The name *L. minima* is preoccupied, *vide* Hegelmaier's monograph p. 156 (*L. minima* Chev.) and must therefore be changed. The plant was described from specimens preserved in formalin and, I fear, the type has been lost.

***Lemna trisulca* Linn. Sp. Pl. (1753) 970. (Pl. I, figs 6-9).**

*Description*¹.—Fronds submerged,² $\frac{1}{2}$ – $\frac{3}{4}$ in.³ long ('not including the tail, which often attains $\frac{1}{2}$ in. long') translucent, thin, flat, elliptic-lanceolate or oblanceolate, crenate-serrate near the apex, the young fronds hastate, at length tailed and attenuated into a stalk by which they remain attached to the parent frond, each frond giving rise to a single root-fibre; root-cap acute. Ovule solitary. Seed semianatropous,⁴ horizontal; testa rough, grooved.

Distribution.—Temperate and tropical regions.

Localities.—none.

Note.—Judging from the fine figure in Hegelmaier's monograph, *L. trisulca* with its large size, and the crenate-serrate margin, should not be difficult to separate from other species, yet there seems to be no authentic records from the Indian region.

Hooker records it from the Punjab on the authority of Stewart, and adds Bengal, the Concan, Munneypore, and Burma.⁵ Cooke records it as occurring in the Bombay Presidency, but gives no precise locality, merely stating, 'In ponds and tanks in the Konkan, not common.' Cooke has evidently not seen any specimens. Fischer excludes it from the *Flora of Madras*. I have seen no Indian specimens.

Kurz records under habitat, 'Bengal, common in standing water!' Though Kurz is supposed to have seen this species in Bengal, Hooker omits to record the fact. Yet Kurz under distribution indicates that he has seen the plant in Europe; he does not however indicate, by the usual 'note of exclamation', that he has seen it in Asia!

Lemna Eleanorae* McCann sp. nov. (Pl. II, III, and IV).

Description.—Fronds floating, 2-3 mm. by 1.5-2 mm., bright green above, paler beneath, semi-translucent, obovoid or elliptically obovoid, symmetrical or asymmetrical, with a longitudinal median ridge, highest towards the base above the insertion of the root, surmounted by two (sometimes 3) sharply pointed conical cusps, one on the highest point of the ridge, the other, near the apex; ventrally a shallow groove corresponds to the ridge above; apex obtuse; margins entire, hyaline; obscurely 3-5 nerved. Young fronds: semi-orbicular, with a single apical cusp. 2-4 fronds remain attached to each other. Root solitary, up to 20 mm. long; root-cap acute. Spathe 0.6×0.5 mm. suborbicular transparent, reticulately veined, apex obtuse, rounded. Stamens 2; filament when mature slightly longer than spathe; anthers 2-celled, cells orbicular, dehiscing by a median suture. Pollen minute, echinate, translucent. Pistil solitary slightly longer than spathe; ovary: urceolate, sessile, 1-celled; stigma infundibuliform; ovule solitary. Seed 0.7×0.35 mm. (including pericarp) ellipsoid, faintly longitudinally ribbed, ribs 12-14, traber-
culate.

L. Eleanorae resembles *L. perbusilla* Torr. in shape but differs from it in possessing the hicuspidate ridge of *L. angolensis* as figured by Hegelmaier (*Lemnae* pls. VI, figs. 19-20 and VII, figs. II); it however differs from *angolensis* in having fewer ribs to the seed.

Distribution.—India (as far as known).

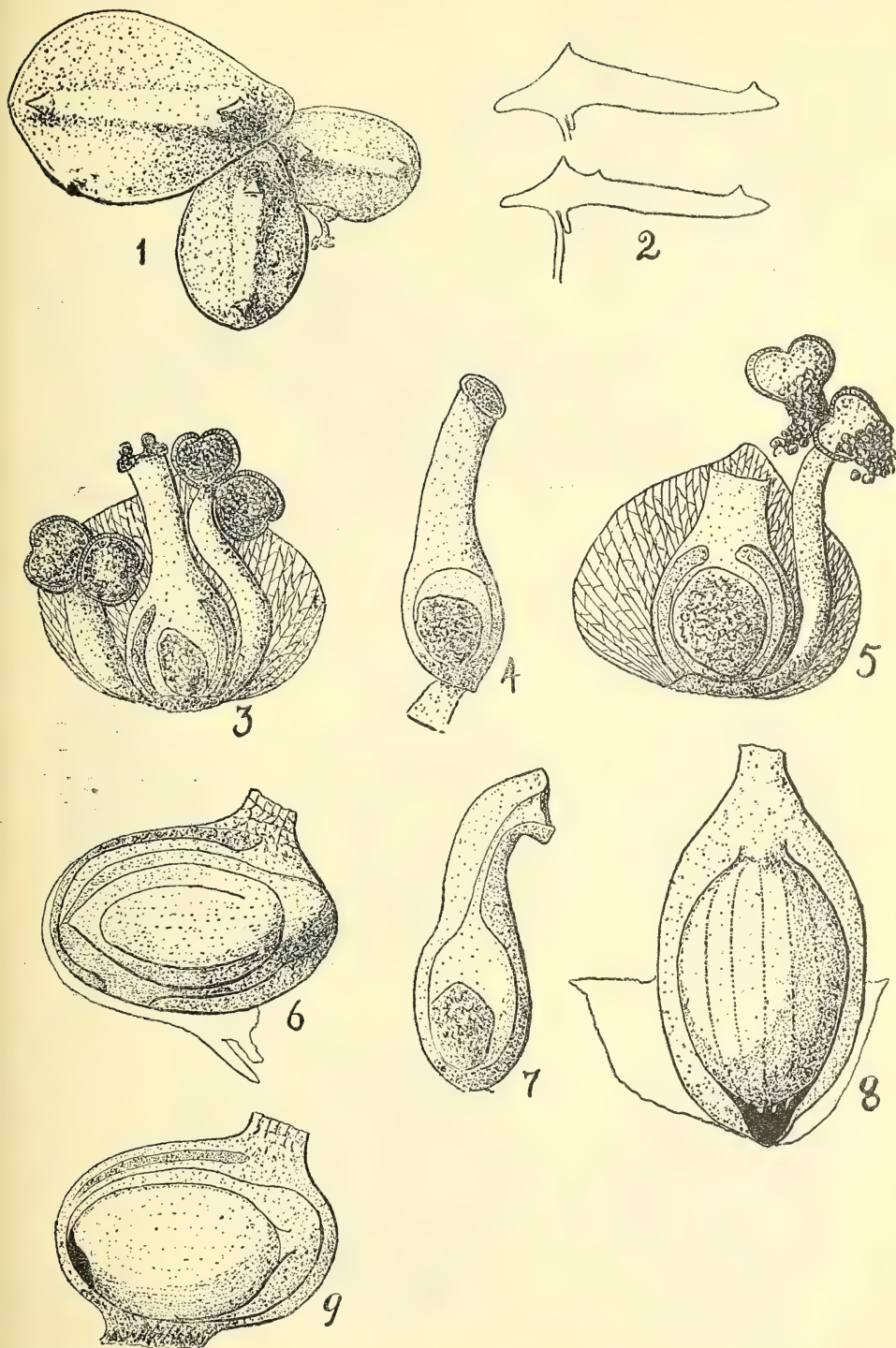
¹ Description after Cooke.

² None of the *Lemnaceae* are submerged.

³ An extremely large *Lemna*—the largest of the order.

⁴ Hemianatropous *vide* Hooker. The position of the ovule has been discussed.

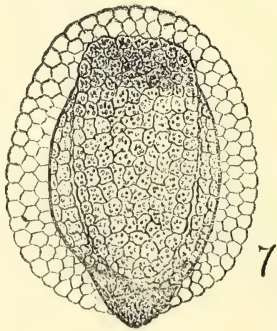
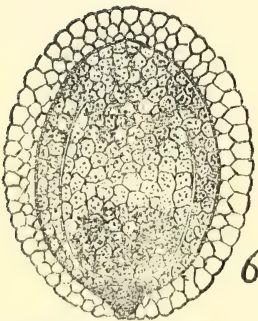
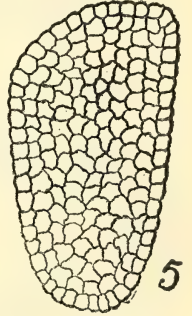
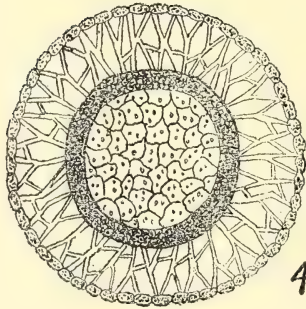
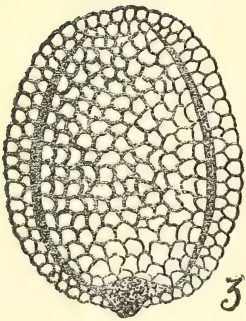
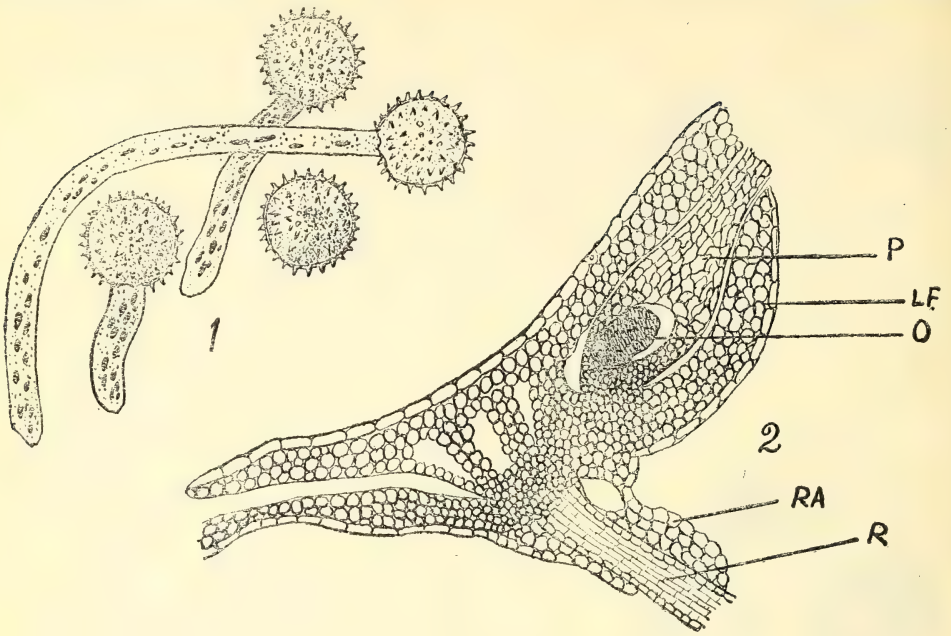
⁵ This plant is named after my wife who has had to do without much of my company during my researches.



Del. McCann.

McCann—Indian Duckweeds. *Lemna Eleanorae* sp. nov.

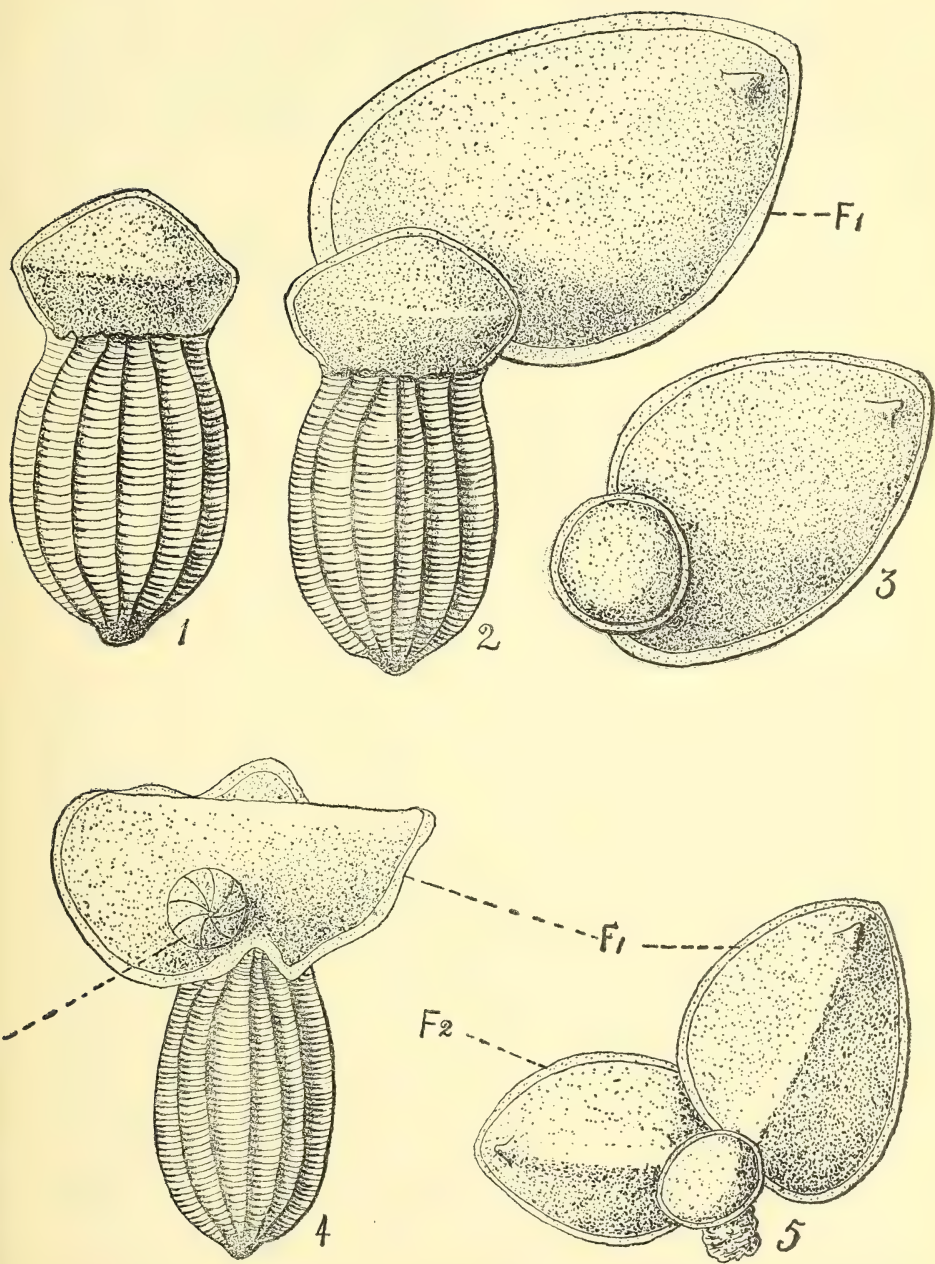
For explanation see end of article.



Del. McCann.

McCann—Indian Duckweeds. *Lemna Eleanorae* sp. nov.

For explanation see end of article.



Del. McCann.

McCann—Indian Duckweeds. *Lemna Eleanorae* sp. nov.

For explanation see end of article.

Localities.—INDIA: Borivli, in a quarry, Salsette Isl. (McC. 7-9-35 Type!) in flower and fruit; Condita Tank, Salsette Isl. (McC. 23-6-40!) near Condita Tank (McC. 4-2-40!) in flower and fruit; Tulsi Lake, in slow trickle of water anchored in the ooze, in shade (McC. 7-4-40!); Thana, in a tank, mixed with *Wolffia* (H. Abdulali 2-9-35!) in fl. and fr.; Uttan, in a well near the sea shore (McC. 24-2-40!) in fl. and fr.; Shilar, Bhiwandi—Wada Rd. (McC. 28-7-40!); Lat. Ichalkaranji Gaghir, mixed with *Wolffia* (Col. Frere!); Alapakam, near Tambaram, Chingleput Dist. (Barnes Nov. 1937!); High Range, 3,500 ft. Travancore (Barnes Sept. 1937!).

Lemna gibba Linn. Sp. Pl. (1753) 970. (Pl. I, fig. 5).

Description¹.—Fronds floating, suborbicular, entire, not tailed $\frac{1}{8}$ – $\frac{1}{2}$ in.² in diam., opaque, thick, flat above, at length very convex beneath, the young fronds sessile, each giving rise to a single root-fibre, the undersurface at length spongy and greatly swollen; root-sheath elongate, cylindric; root-cap acute. Stamens 2. Utricle opening circumsessily. Seeds erect,³ anatropous⁴; albumen scanty or o.

Distribution.—Cosmopolitan.

Localities.—None.

Note.—Regarding the occurrence of *L. gibba* in India, Hooker says: 'Still waters throughout India, ascending to 7,000 ft. in the Himalayas.' Hegelmaier does not record it from India. Cooke records it from the Bombay Presidency on the authority of Woodrow, 'Boshri near Poona', but has seen no specimens. Fischer records it from the Madras Presidency in general terms: 'In still waters in all Districts', but there is no indication that he has seen specimens of this plant.

Hegelmaier's excellent figure, the large size of the plant and the characteristically tumid fronds should be sufficient to distinguish this species from any of the other *Lemna* species. So far I have seen no specimens from India and I doubt if it occurs there at all.

Genus: SPIRODELA

The genus *Spirodela* has been included, by some authors, under the genus *Lemna*, and by others raised to full generic rank. Hegelmaier retained it as a separate genus and I favour this view which is justified by the following points: (1) the numerous roots, (2) the formation of resting buds, and (3) the number of ovules (2 ovules).

Fronds.—Except for a few variations the fronds of *Spirodela* exhibit the characters of the Order. In *Spirodela* there is a tendency for a greater number of fronds to remain attached to one another, and these arrange themselves in a semicircle. Another point worthy of note is that the 'thread-like' axial portion sometimes grows to a considerable length, exceeding the length of the frond by two or more times. In the case of *S. polyrrhiza* the undersurface of the plant is a deep purple, but under certain circumstances this usually characteristic colour may disappear entirely. Some specimens growing in shaded localities, and those left in glass aquaria are good examples. When light is reflected on to the underside the purple colour usually vanishes. On the strength of the absence of the purple colouring, Kurz described a variety of *S. polyrrhiza* under the name *concolor*. According to his statement the 'variety' was found under trees in Bengal. Thus we see that the colouring of the underside is of no value as a diagnostic character. Size and shape are also varying characters.

Formation of new fronds.—New fronds may be developed on either side of the existing frond in 'pockets' near the base. The new frond is formed on a short extension of the 'axial thread', as a branch, which may elongate. The new frond is developed between an upper and lower scale; but instead

¹ After Cooke.

² $1\frac{1}{2}$ –3 lines, Gray, *Manual of Bot. N.U.S.A.* (1876) p. 470.

³ Hooker says, 'Ovules 2-7'; Hegelmaier (*Lemnae*, 145) 'Seeds 1-6'.

⁴ The position of the ovule has already been discussed.

of evolving normally into an additional frond it may become arrested in its growth and form a 'resting bud', in which case it remains orbicular, thick, and highly charged with reserve material.

Resting buds.—In *S. polyrhiza* the development of resting buds is most profuse, as flowers appear to be more rarely developed than in *Lemna*. Specimens under observations, both in the field and in aquaria, continued to produce resting buds, and it was only after four years of close search that I discovered flowers on the 22nd August, 1937, in the Powai Lake, Salsette Island. As already indicated, the resting bud is a modified frond which assumes its true character on vegetating. On maturing as a resting bud it detaches itself from the parent frond and sinks to the bottom. Here it lies dormant till the next season, but where water is perennial, it will rise again to the surface after a few days' rest and become a normal frond, except that it is generally smaller, and more orbicular than the ordinary fronds. Dried resting buds shrink and curl, but remain unimpaired. The dry condition facilitates their rise to the surface as soon as favourable conditions obtain. Resting buds vegetated readily when placed in water after being kept dry under normal conditions for two years.

Roots.—The roots may be short or long, few or many, deeply pigmented or not. The number of roots often varies with the size of the plant, but there is always more than one.

Flowers.—As in the order.

Spathe.—The spathe is orbicular and composed of two layers of cells.

Pistil.—The pistil is flask-shaped, flatter on the ventral than on the dorsal side.

Ovules.—There are two ovules (more than two according to some authors). Neither ovule appears to mature to seed (*S. polyrhiza*), and I have failed to obtain seed. I suspect some imperfection in the floral organs; hence the profuse production of resting buds.

Spirodela polyrhiza (Linn.) Schleid. in Linn. V. 13 (1839) 392. (Pl. V & VI)

Lemna polyrhiza Linn. Sp. Pl. (1753) 970.

*Description*¹.—Fronds herbaceous, broadly obovate or orbicular, not tailed, floating, opaque, thick, flat above, slightly convex below, $\frac{1}{4}$ – $\frac{1}{2}$ in. in diam., dark green above, usually purplish beneath, 7-viewed;² epidermal cells with sinuous walls; young fronds sessile, each frond giving rise to a tuft-fibre.⁴ Spathe 2-lipped.⁵ Stamens 2. Ovules 1-2,⁶ semianatropous.⁷

Distribution.—Temperate and tropical regions throughout the globe.

Localities.—Royal Botanic Gardens, (3-8-35) Biswas!; McCann!; Rangoon, Kamayut pond (10-8-36, 26-9-36) Khanna!; Mandalay (May 1935) Khanna!; Kolapur (7-9-35) Col. Frere!; Secunderabad, Deccan (Oct.-Nov. 1937) Fernandes!; Conditia Tank, Salsette (1-12-35) McCann!; Powai Lake, Salsette (22-8-37 in flower) McCann!; Matunga, in a borrow pit, Bombay, McCann!

Note.—Resting buds: The resting buds measure 5.7×4.5 mm. They are orbicular or broadly elliptical, thick and firm. The dorsal surface is flat or slightly convex, the lower strongly concave. On the dorsal surface is a small orbicular scale equalling the bud in size or somewhat smaller; free from its base. Below is a ventral scale, obovate-oblong and slightly narrowed at the base. It is persistent throughout. The lower half or two-thirds of this scale is fixed, the remainder free. It exhibits a more or less lunate arrangement of raphids. On either side of the ventral scale there is a small broadly ovate scale. Both scales are composed of single layers of cells and are transparent.

A longitudinal section through the centre of a resting bud at an early stage of development into a new frond reveals an elliptic body of embryonic tissue

¹ Description mainly after Cooke.

² 2-4 lines, Gray (*Man. Bot. N.U.S.A.*, 479).

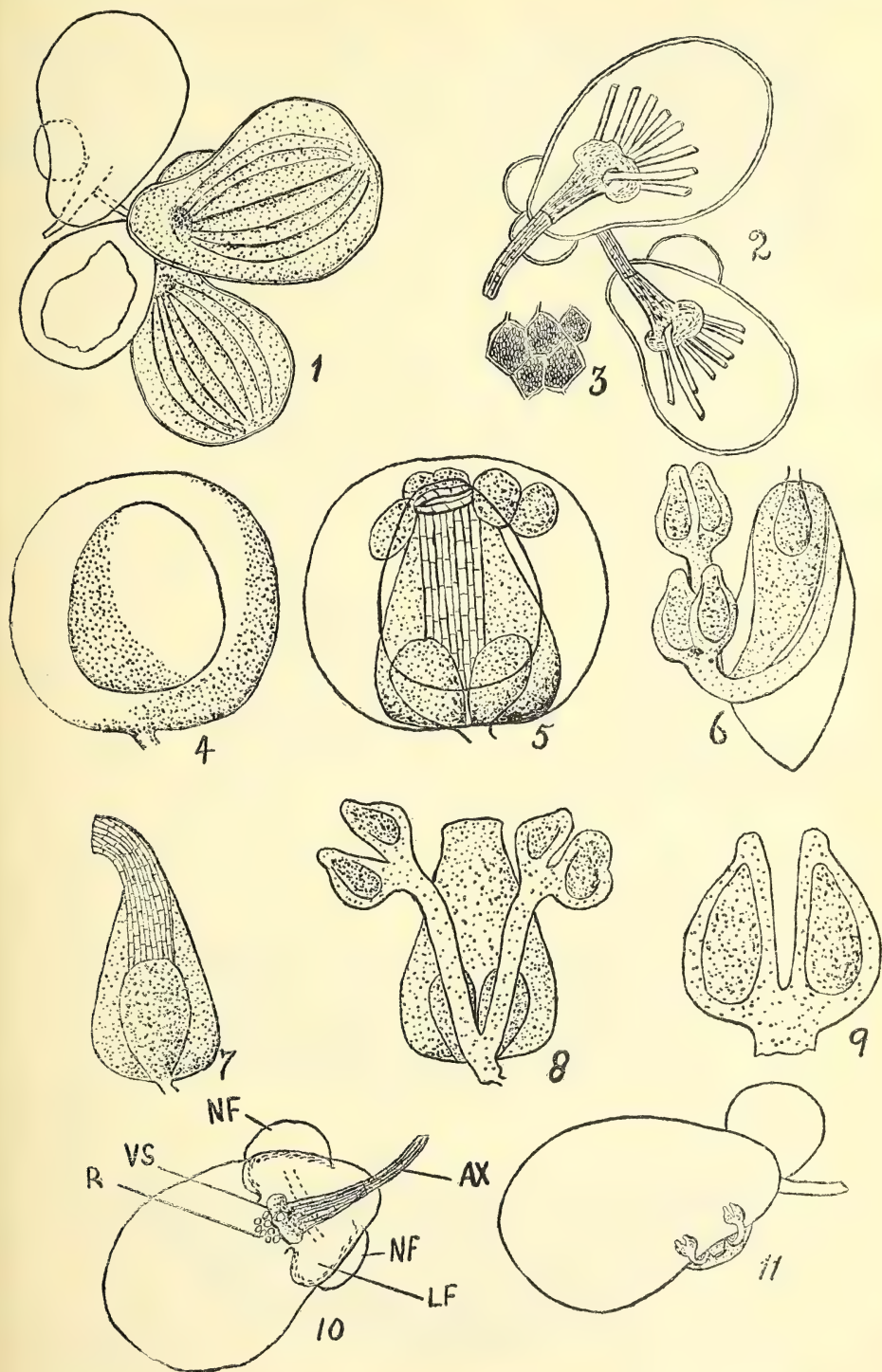
³ 5-11 nerved: Hegelmaier. In figure 12 of table xv Hegelmaier.

⁴ 'Roots many' Hook, 'up to 16 roots' Hegelmaier.

⁵ Not observed by me in fresh material.

⁶ It has been my experience that two ovules only are developed.

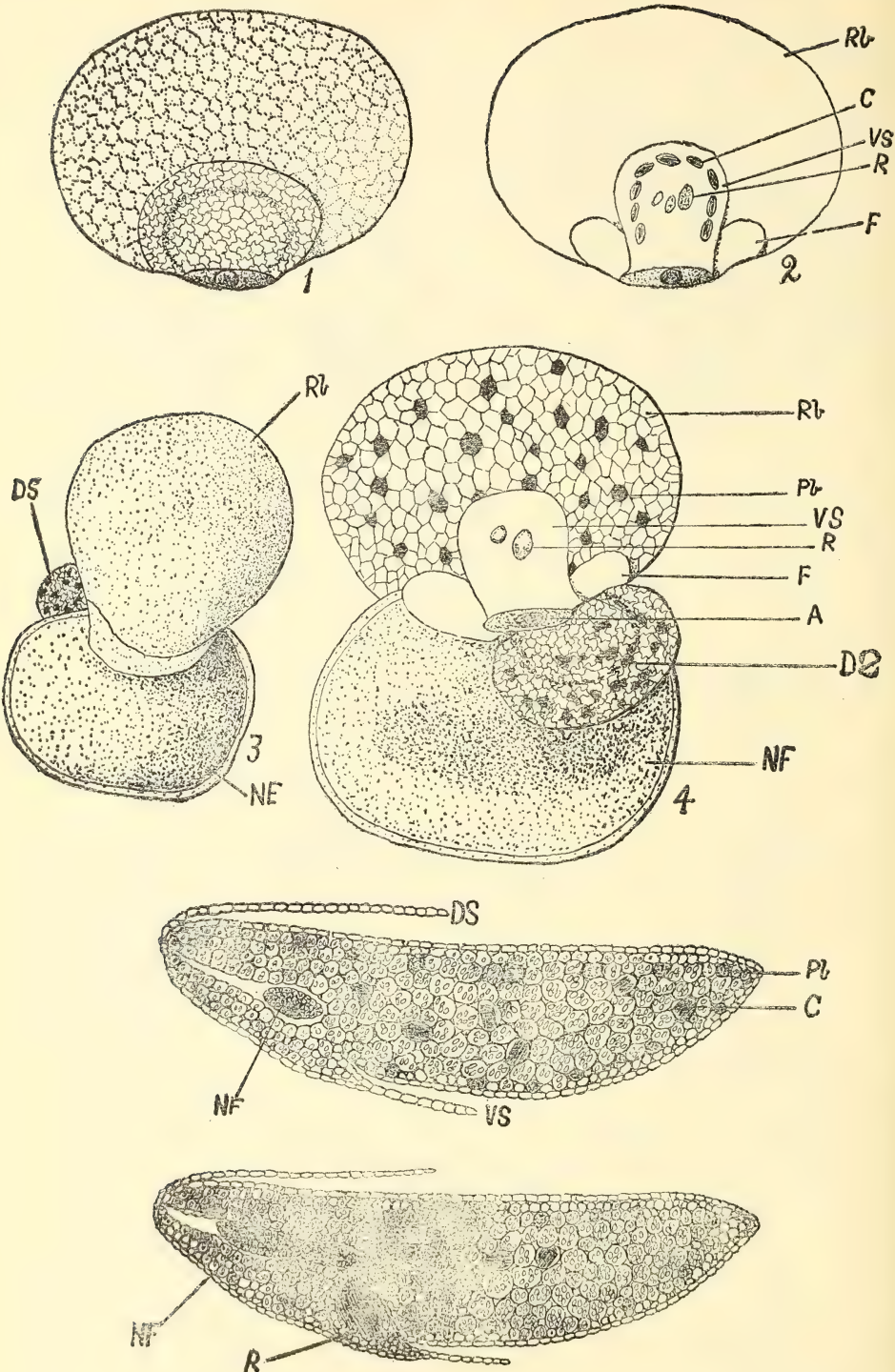
⁷ Position ovule has already been discussed.



Del. McCann.

McCann—Indian Duckweeds. *Spirodela polyrrhiza* (Linn.)

For explanation see end of article.



Del. McCann.

McCann—Indian Duckweeds. *Spirodela polyrrhiza* (Linn.)

For explanation see end of article.

in a cavity with a narrow passage leading to the base of the dorsal scale. A similar section at a later stage of growth shows the elongation of the embryonic tissue up the passage, while at the same time, another projection of the embryonic tissue thrusts its way towards the free base of the ventral scale. These developments represent the formation of the future frond and root respectively. As the new frond develops it protrudes below the dorsal scale and finally pushes it to the ventral surface. The new root does not displace the ventral scale but perforates it. In *S. polyrrhiza* usually only one root pierces the scale but occasionally two may do so, particularly in large specimens. The other roots form below the free portion of the scale thereby pushing it aside.

Spathe.—The spathe is an orbicular 'saccate' organ enclosing the floral parts. It is composed of two layers of cells, is firmer in texture than in *Lemna* and the protruding stamens rupture the top giving it the appearance of being bifid or bilobed. Numerous aggregate crystals and raphids are present in the cells.

Flowering and Fruiting.—Few botanists have ever seen the flowers of *polyrrhiza* as it seldom flowers, the place of the flowers being taken by resting buds. When in flower two ovules are developed, but they never (in my experience) mature to seed. The reason for this, as already remarked, I suspect is due to some imperfection in the floral elements, as the anthers do not appear to dehisce.

Spirodela oligorrhiza Hegelmaier, *Lemnae* (1868) 147, t. 16. (Pl. I, fig. 16 & Pl. VII.)

Lemna oligorrhiza Kurz. *Journ. Linn. Soc.*, ix (1867) 267.

Description.—Fronds flat, thin suboblique, oblong or obtuse, 2-3 rooted, purple below. Fronds arranged in circinate groups, 3-4 lines long by $1\frac{1}{2}$ -2 lines broad, deep green, shining, 1-3 ridges. Roots two, often three, yellow or greenish, flaccid, very long. Flowers as in *L. minor*,² but filaments of the anthers slightly exerted. Pollen granular. Ovules 2—, rarely one, rosy.

Distribution.—India.

Localities.—None.

Note.—A comparison of Kurz's illustration with those of Hegelmaier's plate xvi clearly indicates that these two authors had totally different conceptions of *S. oligorrhiza*. Kurz figures the inflorescence minus the spathe, but evidently Hegelmaier had not seen any flowers, as they are not illustrated in his work. Hegelmaier's figures of *oligorhiza* appear much like those of *polyrrhiza*. The number of roots also exceeds the number mentioned by Kurz.

A curious fact is that no worker, as far as I am aware, appears to have found Kurz's *oligorhiza* since it was described in 1867. Yet Hegelmaier includes varieties under this species (*S. oligorrhiza*)! I am inclined to the view that Hegelmaier's *oligorhiza* is no other than *S. polyrrhiza*. How are we to account for the disappearance of *oligorhiza*? A critical analysis of Kurz's illustrations tempts me to say that the artist has confused two different plants, a *Lemna* and a *Spirodela*. In his description of *S. oligorrhiza* Kurz indicates that the fronds are arranged in 'circinate groups', figure 1 does not bear this out. Such grouping of fronds as depicted in figure 1 I have not observed in any Indian species. Figures 2, 3 and 4 are enlargements of the plants showing fronds, roots and inflorescence *in situ*. In my opinion the shape of the frond is that of *L. minor*. Kurz recognised this fact and wrote, 'It has the size and form of *L. minor*, but the bright green surface and purple-coloured undersurface of *L. polyrrhiza*'. The last clause of this sentence is difficult to explain—no Indian *Lemna* or *Spirodela*, I know, has a purple undersurface barring *S. polyrrhiza* (and *S. maxima*). Again multiple roots in a *Lemna* are difficult to account for—in *Lemna* the root is solitary—unless we admit that the artist has confused two different plants. Figure 4 seems

¹ Description after Kurz.

² This statement is rather misleading as the inflorescence in *Lemna* and *Spirodela* is similar in arrangement, but the ovule in *L. minor* is always solitary whereas in *Spirodela* there are two ovules.

to me to be a flowering frond of *L. minor*, but here again the three roots is the obstacle. Figure 5 is undoubtedly the inflorescence of a *Spirodela*, but the spathe has been omitted. The female flower as depicted agrees closely with my own figure of the inflorescence of *S. polyrrhiza*.

As the plants were growing together such an error may quite easily occur. Young and feeble plants of *S. polyrrhiza* frequently have but few roots.

The type sheet of Kurz's *L. oligorrhiza* is in the herbarium of the Royal Botanic Gardens, Sibpur, Calcutta. Unfortunately circumstances do not permit my examining this sheet. Pressed material of *Lemnaceae* is very unsatisfactory as the size of the plants and the delicateness of the tissues, particularly the roots, soon damage and examination of such material will undoubtedly lead to poor results.

Strangely enough Kurz's *oligorhiza* was recorded from Australia in 1888. Dr. W. Wools in an article, *Lemnaceae or Duckweeds* [*Proc. Linn. Soc. N.S.W.*, 2nd series iii (1888) 1247] records:—

'Of the genus *Lemna*, the Baron (Baron Mueller) gives for Australia five species, three of which, *L. trisulca* (Linn.), *L. minor* (Linn.) and *L. gibba* (Linn.), have only one root or fibre; whilst *L. oligorrhiza* (Kurz), which the writer collected in Paramatta, has five roots or more, and *L. polyrrhiza* (Linn.) a cluster of many.

Dr. Wools says that *oligorhiza* 'has five roots or more' while Kurz says, 'roots 2-3'; and this seems to show that the two, *oligorhiza* and *polyrrhiza* were merely separated by him (Dr. Wools) on the number of roots. As I doubt the specific value of *oligorhiza*, I am of opinion that the two Australian 'species' as recorded by Dr. Wools are one and the same plant.

***Spirodela maxima* McCann nov. comb. (Text-fig. 1).**

Lemna maxima Blatt. & Hall. *Journ. Ind. Bot.*, v, 11 (1921) 49.

*Description*¹.—Fronds herbaceous, flat on both surfaces, not spongy, growing in humid soil, thinly coriaceous, brittle, opaque, symmetrical, suborbicular,

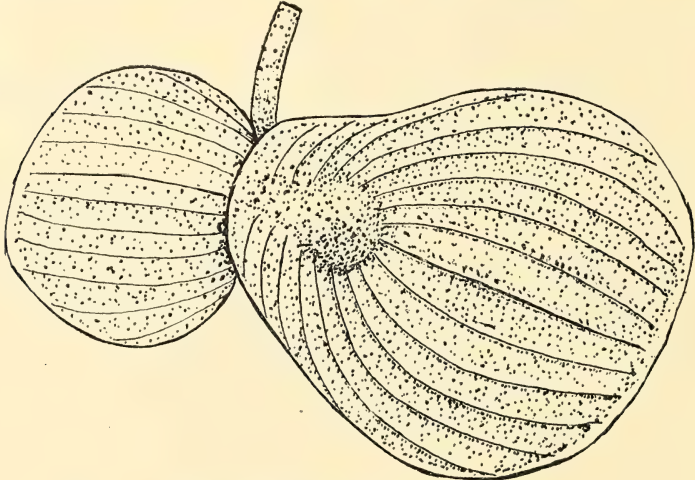
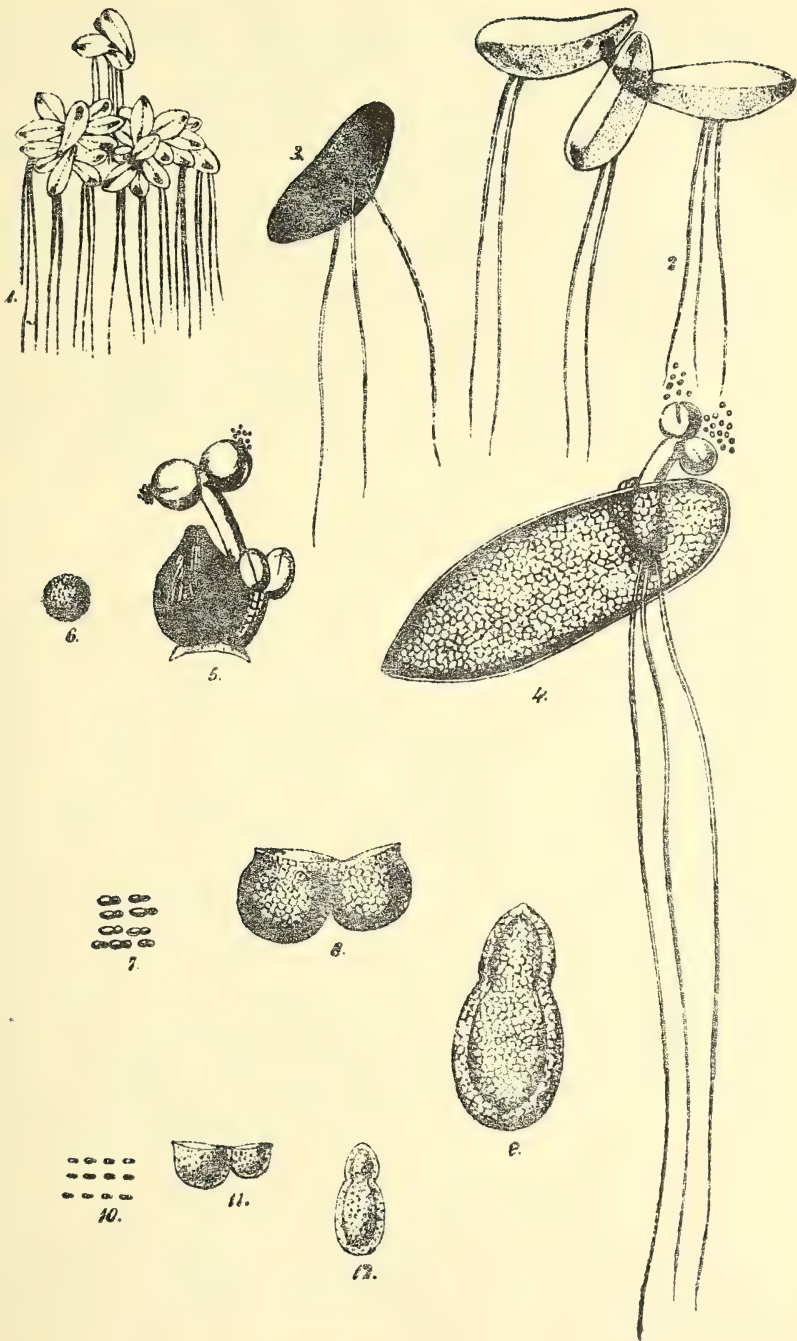


Fig. 1.—*Spirodela maxima* comb. nov.

broadly ovate or obovate, about 13 mm. long by 10 mm. broad, 9 nerved.² upper surface deep green, lower purple, from the lower surface numerous (about 17), fascicled roots 30 mm. long are given off, young fronds sessile.

¹ Description after Blatter & Hallberg.

² Many more nerved.



McCann—Indian Duckweeds. *Spirodela oileggorrhiza* Hegelm. (figs. 1-6).
Reproduced from Kurz's illustration (Linn. Soc. Journ. Bot., Vol. IX, p. 5).
For explanation see end of article.

Distribution.—India.

Localities.—Achalgar, Mt. Abu, 1,300 mm. Rajputana (Blatter 1856, type), McCann!

Note.—The type No. 1856, Herb. St. Xavier's College, Bombay, I fear is now non-existent. I was with the authors at the time when the original plants were collected. On the 15th December 1938 I had the opportunity of revisiting Achalgar where I obtained fresh material for study. The original material was collected from a gently flowing stream, an overflow of an artificial tank. At the time of my second visit the stream was dry, but I obtained sufficient material from the tank, which material, in the absence of the type, may now be considered the *topotype*. The slushy banks of the tank were covered thickly with growths of *maxima*, which had sent roots into the soil.

In the original description the authors stated 9-nerved; on an examination of the fresh material obtained by me I find that there are many more nerves, double the number. In the preserved specimens the nerves appear canalliculate and radiate from the point above where the roots appear below, to the margin. The margin is hyaline or nearly so and tinged with purple (fresh). The basal scale is perforated by two roots as a general rule.

In my opinion *S. maxima* is very likely an extremely large and vigorous form of *S. polyrrhiza*, but until such time as I am able to obtain the flowers the species must stand.

Genus: *Wolffia*

Wolffia the smallest flowering plants in the world. Here the entire plant is reduced to a minute 'globule' of vegetative tissue with an internal 'axial' portion embedded in it, which gives rise to new fronds and the floral elements. The axial portion is inseparable from the rest of the plant. When not in flower there is no indication of any groove or 'pit' in which the floral elements appear, but when in flower the single stamen and pistil appear out of a circular 'pit'. The frond as a definite anterior and posterior end, and the new frond is developed from the posterior 'pocket'. Soon after bearing fruit the entire frond dies and sinks to the bottom of its habitat together with the seed.

Roots.—None.

Resting buds.—No resting buds have been observed.

Male flower.—The male flower is solitary, composed of a single stamen. The anther is globular, mounted on a short filament. It splits across the top when mature. Hooker and Fischer refer to the anther as being *sessile*, but actually this is not the case, as the anther is shortly stalked. Pollen as in the order.

Pistil.—As in *Lemna*. The stigma matures a little after the anther. On the mature stigma there is always a globule of a viscid (?) secretion. When removed another droplet appears shortly after, as in *Lemna*. This stigmatic droplet was first observed in *Wolffia*. Its significance is difficult to surmise, but it probably has some bearing on fertilization—the pollen grains sticking readily to the globule.

Fertilization.—The anther matures a little before the stigma. The pollen spreads over the surface of the plant, but fertilization may be effected by contact with adjacent plants, by insects crawling over the plants resulting in cross-fertilization; or self-fertilization may result by the pollen of the same individual reaching the droplet on the stigma.

Ovule.—Solitary and erect. The plants seed profusely.

Spathes.—None.

Dispersal.—As in the order.

Wolffia arrhiza (Linn.). (Pl. VII, figs. 7-12, Pl. VIII & IX).

Lemna arrhiza Linn. *Mant.* 2 (1771) 294.

*Description*¹.—A minute, granular, floating plant. Fronds opaque, sub-globose, ovate or ovate-oblong when viewed from above, 1-1.5 mm. long, slightly convex above, highly convex below, rootless; young fronds solitary and sessile, arising from a pocket at the base of the old frond. Flowers

¹ Description partly after Cooke.

arising from a central cup-like hollow in the centre of the frond. Spathe o. Male flower solitary. Stamen short, slightly exceeding the depth of the floral cup; anther globose, 1-celled; pollen echinate. Female flower solitary. Ovary globose or ovoid; ovule solitary. Seed ovoid, slightly umbonate at the top.

Distribution.—Cosmopolitan.

Localities.—Dehli, 12-2-36 (S. H. Meheralli 174!); Sibpur, Royal Botanic Gardens, 2-8-35 (Biswas!), (McCann!); Lat, Ichalkaranji Jagir, Deccan, mix with *Lemna* (K. V. Tamhankar!); Alapakham, Chingleput Dist., Nov. 1937 (Barnes!); Thana, in a weedy tank mixed with *Lemna*, 2-9-35 (H. Abdulali!); Ghorbundar,¹ Salsette, in a masonry tank, 11-3-37 in flower (McCann!); Uttan,² Thana Dist., in a well mixed with *Lemna*, 24-2-40 (McCann!); Belgaum, in a well, 6-6-38 (McCann!).

CONCLUSION.

Of the six species of *Lemna* mentioned in this paper two *L. trisulca* and *L. gibba*, do not appear to occur in India and must accordingly be excluded from the Indian Flora. *L. paucicostata*, *L. Blatteri* and perhaps also *L. Eleanorae* are probably identical with *L. minor*, but must for the present be regarded as distinct till the subject has been further investigated. The original descriptions are in many cases so meagre and the plants so variable within limits, that they have tempted authors (myself included) to create new species often based on the fronds alone. In the case of *L. Eleanorae*, I created the species in order to give a description which would include details which do not tally with those of the other species as described at present. Further I have given details of the development and other notes of interest.

Of the three species of *Spirodela*, I regard *S. maxima* as being an extreme form of *S. polyrrhiza*, but must leave it separate for the present until such time as flowers are obtained. *S. oligorrhiza* I regard as a composition of the characters of *L. minor* and *S. polyrrhiza* and therefore no species.

Wolffia arrhiza I believe to be the only species of the genus occurring within Indian limits.

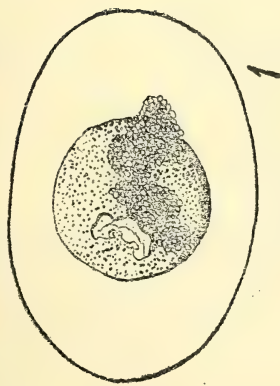
Thus, if my views are correct, the Indian members of *Lemnaceae* amount to three: *L. minor* L.; *S. polyrrhiza* L. and *W. arrhiza* L.

ACKNOWLEDGEMENTS.

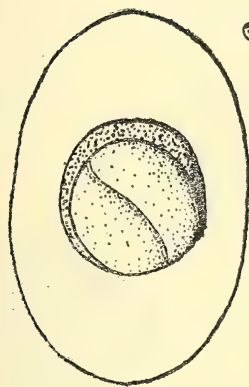
I wish to express my thanks to the following gentlemen for sending me material of *Lemnaceae* from their respective districts: Mr. K. Biswas, Royal Botanic Gardens, Sibpur, Calcutta; the late Col. A. G. Frere, I.A.; Mr. H. Abdulali, Andheri, Bombay Suburb; Mr. E. Barnes; Mr. L. P. Khanna, Rangoon, Burma; Mr. J. Fernandes, Hyderabad (Deccan). Dr. W. C. O. Hill, Medical College, Colombo, Ceylon. To Mr. C. E. C. Fischer, Royal Botanic Gardens, Kew, for copies of certain literature; to Dr. Baini Prashad, Indian Museum, Calcutta, for the photographic copy of Kurz's plate; and lastly but not least to Rev. Fr. J. F. Caius, St. Xavier's

¹ Entire surface of tank covered thick with this plant only.

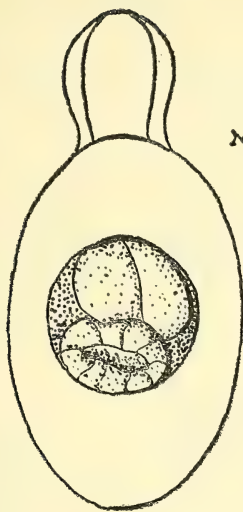
² The well was not more than 500 yds. from high tide level.



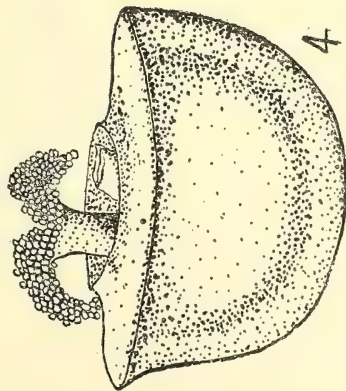
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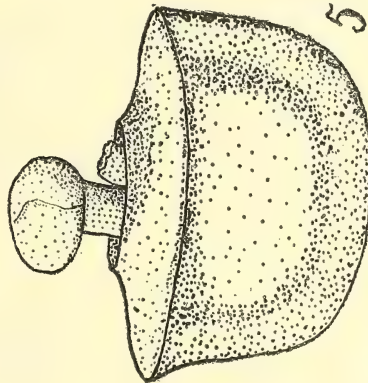
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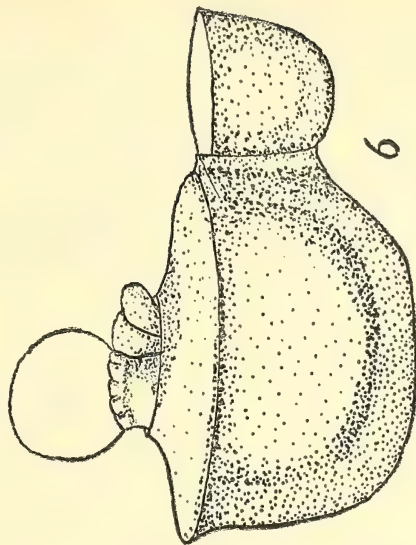
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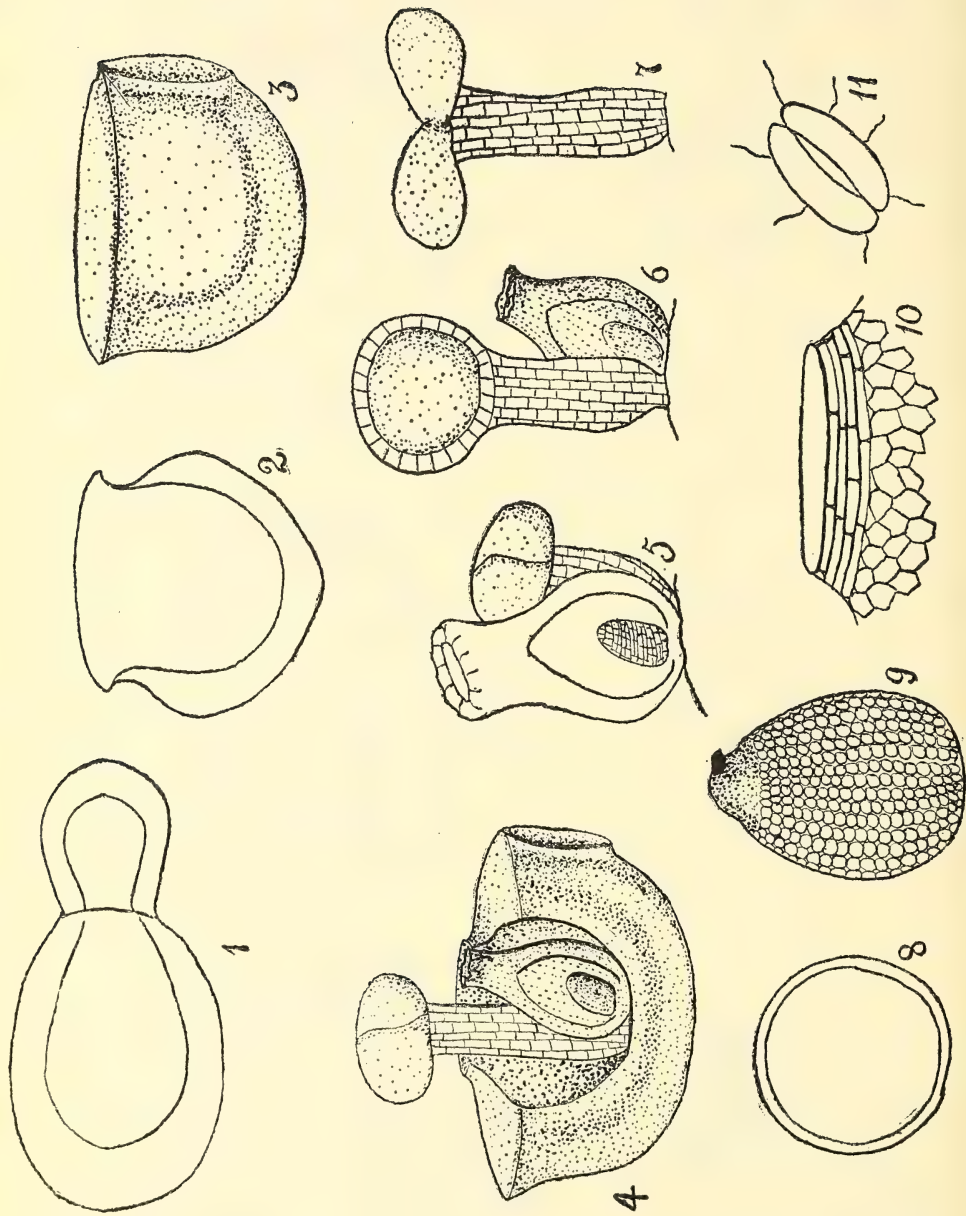


6

Del. McCann.

McCann—Indian Duckweeds, *Wolffia arrhiza* (Linn.)

For explanation see end of article.



College, Bombay, for going through the MS. and making useful suggestions.

EXPLANATION OF PLATES.

PLATE I.

- Fig. 1.—*Lemna minor* (Seedling).
 Figs. 2, 3 and 4.—*L. paucicostata*.
 Fig. 5.—*L. gibba*.
 Figs. 6, 7, 8, and 9.—*L. trisulca*.
 Fig. 10.—*Spirodela oligorrhiza*.

PLATE II.

***Lemna Eleanorae* McCann sp. nov.**

- Fig. 1.—Entire plants.
 Fig. 2.—Longitudinal outline of fronds showing conical spikes.
 Figs. 3 and 5.—Inflorescence.
 Figs. 4 and 7.—Pistil.
 Figs. 6, 8 and 9.—Fruit: (6) Young fruit; (8) a little older, seed horizontal; (9) seed in vertical position.

PLATE III.

***Lemna Eleanorae* McCann sp. nov.**

- Fig. 1.—Germinating pollen.
 Fig. 2.—Transverse section of frond. P. pistil; L.F. lower flap of 'pocket'; O. ovule; R.A. root appendage; R. root. (spathe not drawn).
 Figs. 3-7.—Sections of germinating seed. 3, 6 and 7, L.S. of seed; 4 T.S. of seed; 5 L.S. of embryo.

PLATE IV.

***Lemna Eleanorae* McCann. sp. nov.**

- Fig. 1.—Germinating seed showing cotyledon (1st stage, 14-5-36).
 Fig. 2.—Further stage in development with first frond (19-5-36).
 Fig. 3.—Fig. 2 viewed from above.
 Fig. 4.—Same as Fig. 2 but frond reversed to show root appearing.
 Fig. 5.—The same plant with two fronds on 26-5-36 (No roots developed as yet).
 F. 1. 1st frond; F. 2, 2nd frond; R. root.

PLATE V.

***Spirodela polyrrhiza* (Linn.)**

- Fig. 1.—Dorsal view of plants.
 Fig. 2.—Ventral aspect.
 Fig. 3.—Texture of undersurface.
 Fig. 4.—Spathe only.
 Figs. 5 and 6.—Inflorescence with spathe.
 Fig. 7.—Pistil (side view).
 Fig. 8.—Pistil and stamens (ventral view).
 Fig. 9.—Anther.
 Fig. 10.—Ventral aspect of frond showing details.
 Fig. 11.—Dorsal aspect of frond. (L.F.=lower flap of frond; N.F.=new frond; R.=roots; V.S.=ventral scale of frond; A.X.=axial thread).

PLATE VI.

Spirodela polyrrhiza (Linn.).

- Fig. 1.—Resting bud (dorsal aspect).
 Fig. 2.—Resting bud (ventral aspect).
 Fig. 3.—Developing resting bud (dorsal aspect).
 Fig. 4.—Same (ventral aspect).
 Figs. 5 and 6.—L. S. through resting bud.
 A=attachment; C=raphids; D.S.=dorsal scale; F.=flap of ventral scale;
 N.F.=new frond; Pb=pigment body; R=root; Rbre=resting bud; V.S.=ventral
 scale.

PLATE VII.

- Figs. 1-6.—**Spirodela oligorrhiza** Hegelm.
 Figs. 7-12.—**Wolffia arrhiza** (Linn.) Figs.

For explanation *vide* text, pp. 120-21.

PLATE VIII.

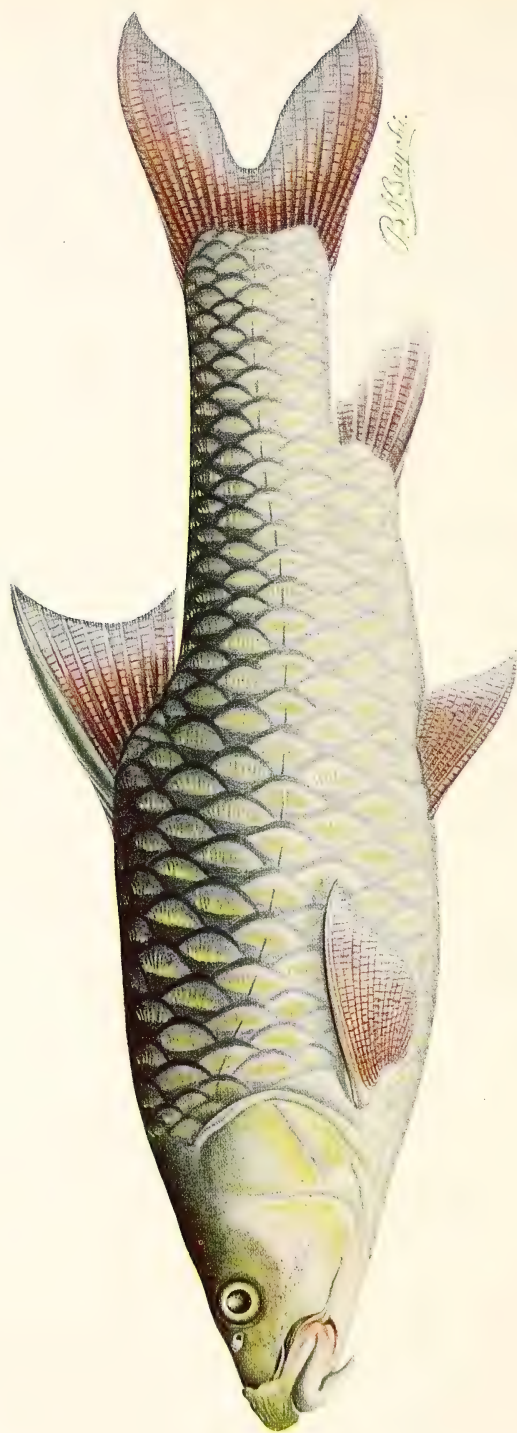
Wolffia arrhiza (Linn.).

- Figs. 1, 2 and 3.—Top view of flowering plants.
 Figs. 4, 5 and 6.—Side view of same.
 Note the droplet of secretion on the stigma in Fig. 6.

PLATE IX.

Wolffia arrhiza (Linn.).

- Fig. 1.—Dorsal outline of plant with bud of new frond.
 Fig. 2.—Transverse outline of plant.
 Fig. 3.—Plant showing 'socket' of new frond.
 Fig. 4.—Showing position of floral parts.
 Fig. 5.—Pistil and stamen.
 Fig. 6.—As fig. 5, showing texture of stamen.
 Fig. 7.—Stamen dehiscent.
 Fig. 8.—Cross-section of outline of seed.
 Fig. 9.—Seed.
 Fig. 10.—Structure of floral cavity.
 Fig. 11.—Stomata.



The Khudree Mahseer.
BARBUS (TOR) KHUDREE Sykes.

THE GAME FISHES OF INDIA.¹

BY

SUNDER LAL HORA, D.SC., F.R.S.E., F.Z.S., F.R.A.S.B., F.N.I.,

Assistant Superintendent, Zoological Survey of India, Calcutta.

(With one coloured plate and one black and white plate)

(Continued from page 815 of Vol. xlii, No. 4.)

XV. THE MAHSEERS OR THE LARGE-SCALED BARBELS OF INDIA.

8. ON THE SPECIFIC IDENTITY OF SYKES'S SPECIES OF *Barbus* FROM THE DECCAN.

CONTENTS.

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<i>Barbus mussullah</i> Sykes	164
<i>Barbus khudree</i> Sykes	167
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Explanation of Plates	169

INTRODUCTION.

Having discussed chronologically in the preceding six articles the specific limits of the Large-scaled Barbels described by Hamilton (4, pp. 303-307)² and McClelland (7, pp. 333-338) from Northern India, we now turn to the species of *Barbus* described by Sykes from the Deccan. In 1838, Sykes (9, p. 159; 10, p. 56; 11, pp. 356-358) read a paper before the Zoological Society of London 'On the Fishes of the Deccan', and described 3 new Barbels, viz., *B. mussullah*, *B. khudree* and *B. kolus*. Of these, *B. kolus* with two barbels, an interrupted labial groove and pertaining to Hamilton's subgenus *Puntius* has been recognised as a valid species by later workers (3, p. 136; 2, p. 573), while the taxonomy of the other two has till recently been in a state of great confusion. In 1919, Annandale (1, p. 135) referred certain specimens from the Kistna river to *B. mussullah* and commented upon the specific characters of the species; while in 1938, Hora and Misra (5, p. 24) discussed and defined the specific limits of *Barbus khudree*. It must, however, be understood that, judging by the present standards,

¹ Published with permission of the Director, Zoological Survey of India.

² Numerals in thick type within brackets refer to the serial numbers of the various publications listed in the bibliography at the end of the paper.

Sykes's descriptions are inadequate and his drawings¹ inaccurate in several respects. We have, therefore, very meagre data to rely upon for elucidating the taxonomy of his species, and a collection of topotypes is essential for defining the specific limits of all the forms described by him from the Deccan. In view of the examination of a large amount of additional material of *B. khudree* from the Western Ghats and the information collected, through the kindness of Dr. M. Suter, D.Sc., from the respective type localities of *B. mussullah* and *B. khudree*, I am in a somewhat better position to evaluate the specific limits of these forms.

***Barbus mussullah* Sykes.**

The following is the full description of the species as given by Sykes (11, pp. 356, 357):—

¹Pectoral fins of 16 rays; ventral of 9 rays; dorsal fin of 12 rays, including the first double ray; tail forked, of 24 rays, including the short rays at each exterior side of the insertion of the tail: a remarkable projecting prominence between the upper lip and nostrils, giving to the fish the appearance of being Roman-nosed: the eyes are situated far back, and between the eyes and the corners of the mouth there are a number of circular, rough, prominent *papillae*, but these are not constant: corners of the mouth furnished with a short feeler, and the base of the nasal prominence, near the tip, also furnished with one on each side: dorsal fin in the centre of the back, on a prominence which slopes suddenly behind; ventral fins on the centre of the belly, on a perpendicular from the first dorsal ray: tail suddenly narrows below, after the anal fin; anal fin with the posterior angle bluntly rounded off. The lateral line is slightly arched at the shoulder, then falls, and runs straight to the anal fin; over this it rises a little, and then runs straight to the centre of the fork of the tail. The whole of the upper parts of the fish are covered with large², coarse silvery scales, having blue and red reflections, and on the under parts a yellow tinge prevails; it is very bony, and its length, to the end of the fork of the tail, is 12 inches, and height, 3 inches; but its greatest growth is 5 feet. When small this species resembles the *Kolus*, but in the latter the colour is more reddish-silvery: the fins are reddish, and the *Mussullah* is a much coarser, and infinitely larger fish. A male brought to me at Seroor³, from the Goreh river, measured in

¹ Regarding his fish illustrations, Sykes (9, p. 157) observed:

'It only remains to state that the whole of my fishes were drawn from absolute measurements, and have a scale of size attached to each figure; they were caught in the various rivers on whose banks I encamped, as individuals were required; so that my draftsman, who worked constantly under my own eye, never had to finish his drawings from shrivelled and discoloured specimens.'

In spite of this assurance, unfortunately much reliance cannot be placed on Sykes's illustrations for the correct identification of the species described by him.

² A perusal of the account of the species described by Sykes shows that by 'large' scales he means up to 44 scales along the lateral line, as all his species with 'small' scales possess 60-70 scales along the lateral line. Sykes's drawing of *B. mussullah* clearly shows that the species is not characterised by large scales in the sense the term is used in the present series of articles.

³ Regarding the type-locality of *Barbus mussullah*, Dr. M. Suter has very kindly given the following note:—

'I believe that Sykes's "Seroor" must be identical with the place called "Sirur" on modern maps. This is a large village 43 miles from Poona on the road to Ahmednagar. It figures in Grant Duff's History of the Mahrattas as "Seroor" and also in the Gazetteers, and was formerly a military Cantonment. It is situated on the Ghod river. The last consonant, being palatal, is pronounced more like an *r* than like a *d* and the name sounds more like Ghore.'

length 3 feet 4 inches, and in height 1 foot, and weighed nearly 42 lbs. avoirdupois. The flesh wanted flavour. The *Mussullah* differs from the *Mosal* of Dr. Hamilton, in having 1 ray less in the dorsal and pectoral fins, and in the first rays of these fins being double instead of quadruple; in the latter respect, and indeed in many others, resembling the *C. Putitora*; it also differs in having the nose and upper lip tuberculated, and in colour. The prominence on the nose is also marked. Russell describes three *Barbels*, calling them *Cyprini*, but none of them are identical with the present fish.¹

In spite of the above fairly long but generalised description and figure of *B. mussullah*, it was not possible for later ichthyologists to recognise its identity. Günther (3, p. 83) regarded it as a species *inquirendum* and Day (2, p. 565) included it in the synonymy of his composite *Barbus tor*. Annandale (1, p. 135) in rescuing this species from obscurity observed :

'Sykes's description of this fish is inadequate, and his figure inaccurate, but he refers to and illustrates one trivial but apparently constant character that gives me confidence in identifying specimens sent by Mr. McIver. This character is the presence under the eye of a group of small tubercles not confined to one sex and visible with the aid of a lens in quite young fish.

'A more important differential character, not recognized by Sykes but shown in his figure, is, however, to be found in the structure of the mouth, the opening of which is much more oblique than in any race of *Barbus tor*. The extremity of the maxillary lies directly under the middle part of the eye. This feature is well shown on plate III. There are 13 (3/10) dorsal and 8 (3/5) anal fin-rays; 25-26 scales in the lateral line, 4 rows of scales above it and 3 below.

'*B. mussullah* is common in the upper Kistna, where it occurs with the local race of *B. tor*. The Mahratta fishermen of Satara never fail to distinguish the two species. *B. tor* they call *Kudis*; *B. mussullah*, *Masundi*. Mr. McIver, to whom I am indebted for this information, has caught a specimen of the *Masundi* 21 lbs. in weight.'

Spence and Prater (9, p. 46) have given a brief account of *B. mussullah* after Annandale and have also recorded *B. tor* from the Deccan.

I have examined Annandale's specimens of *B. mussullah* (local name: *Masundi*) and *B. tor* (local name: *Kudis*) from the Kistna river. If the tubercles on the snout constitute a valid specific character, then we certainly have two distinct species in this material; the nature of the mouth opening is variable and the two species cannot be distinguished on this character. An examination of a large number of specimens from the Western Ghats and Central India shows that the presence of tubercles on the head is not a constant feature as was pointed out by Sykes himself. I now find that some of the specimens from Deolali referred to *B. khudree* by Misra and myself (5, pp. 24-28) also possess tubercles. In fact, the large specimen figured by us has a patch of tubercles on the sides of the head. These tubercles are small and low, and not as prominent as those of the Bokar Mahseer, *Barbus (Lissochilus) hexagonolepis* McClelland. For this reason, unless they are carefully looked for, they are liable to be missed. I am now convinced

¹ Sykes stated that the tuberculated condition of the sides of the head is not constant. In the case of *Barbus kolus*, Misra and I (5, p. 28, pl. i) found that in the males the tubercles on the snout are more numerous and prominent, while in the females only a few small tubercles are present on the sides of the snout. Similar sexual dimorphism is perhaps characteristic of *B. mussullah* also.

that Annandale's *B. mussullah* and *B. tor* are referable to a single species *B. khudree* Sykes.

What then is Sykes's *B. mussullah*? A reference to his description given above shows that 'When small, this species resembles the *Kolus*, but in the latter, the colour is more reddish-silvery: the fins are reddish, and the *Mussullah* is a much coarser, and infinitely larger fish'. Under the description of *B. kolus*, Sykes observed: 'This fish resembles the *Mussullah* much in form, but the latter is a larger and coarser fish, and bluer in colour'. He also compared *B. kolus* with Hamilton's *Cyprinus curmuca* and stated 'Differs slightly from the *Cyprinus curmuca* of Hamilton, in having 2 rays in the dorsal and 1 in the ventral more, and in the scaly appendage to the ventral fins.'

A comparison of Sykes's figures of *B. mussullah* and *B. kolus*, reproduced here, clearly shows the great similarity between the two species in the form of the head and the presence of tubercles on the snout. The differences are in the number of barbels, 4 in the former and 2 in the latter, and the form of the body.

In the fish-fauna of the Western Ghats, there are two kinds of Barbels, *B. curmuca* and *B. kolus*, in which the snout is produced and covered with series of tubercles. According to Day (2, p. 567), *B. curmuca* attains 'at least 4 feet in length,' while *B. kolus* 'upwards of a foot in length'. It would thus appear that the larger fish, *B. mussullah* Sykes, may be identical with *Cyprinus curmuca* Hamilton. Unfortunately, *Curmuca* was described and figured by Hamilton (Buchanan's *Journey from Madras through the countries of Mysore, Canara, and Malabar*, III, p. 344, pl. xxx, 1807; 4, p. 294) with 2 barbels, though in reality this species possesses 4 barbels as described by Day (*Proc. Zool. Soc. London*, p. 707, 1873; 2, p. 567). This species, as pointed out by Day, is remarkable in possessing both pairs of barbels on the maxillaries and none on the snout; the lower barbels are stated to be equal to the length of the orbit while the upper ones are much shorter and are, therefore, liable to be missed, especially when hidden in the maxillary grooves. It is likely that both Buchanan (afterwards Hamilton) and Jerdon (*Madras Journ. Lit. Sci.* XV, p. 306, 1848) overlooked the upper pair of barbels. In Sykes's figure of *B. mussullah*, however, both pairs of barbels are shown as subequal and arising from the maxillaries.

The above information regarding the possible identity of *B. mussullah* with *B. curmuca* was supplied to Dr. Suter, who very kindly undertook to visit Sirur and collect specimens from the type-locality. He visited Sirur in the latter half of November and sent me the following report about his trip in his letter dated the 3rd December 1941:

'My trip to Sirur etc. unfortunately proved abortive as far as collecting specimen of *Barbus mussullah* Sykes is concerned. The Ghod river at Sirur is nowadays very silted up and large fish are there available only during and just after the rainy season.

'I also visited the pools above and below the confluent of the Mutta-Mulah and Bhima rivers, which are famous for holding large fish. These pools were, however, still too deep for netting, and the local fishermen asked me to come sometime in January or February.



Copies of Sykes's drawings of *Barbus mussullah* and *B. kolus*,
a. *Barbus mussullah* Sykes; *b.* *Barbus kolus* Sykes.

'In all the places visited "*mussullah*" seems to be well known to the fishermen. There is no question of these men confusing it with mahaseer, as they all declared that '*mussullah*' is quite distinct from mahaseer. They describe it as a long fish with large scales and with a long head, the mouth being more blunt than in mahaseer, owing to the upper parts of head and mouth being higher. This feature corresponds to Sykes's remark about its being Roman nosed. It is described as silvery on lower parts and sides and dark on the back.

'When shown the pictures in Day's book they picked out the picture of *Barbus curmuca* as representing '*mussullah*'. This is indeed very interesting, and I hope another visit to the pools below and above the confluent of the Bhima and the Mutta-Mulah in the netting season will solve the question.

'I further visited a large pool in the Mutta-Mulah some 15 miles south-east of Poona, where the local men gave the same description of '*mussullah*' as mentioned by their colleagues at Sirur etc. They say that they catch this fish mainly in August and September, after which time the fish retire to the much deeper pools further downriver.'

Though the absolute identity of *B. mussullah* with *B. curmuca* can only be established after an examination of the specimens from the type-locality, from the taxonomic findings detailed above and the field investigations carried out by Dr. Suter, there seems hardly any doubt that *B. mussullah* is in all probability a synonym of *B. curmuca*. If that be so, *mussullah* is not a fish of the Mahseer or *Tor*-type, but of the *Puntius*-type.

***Barbus khudree* Sykes.**

Hora and Misra (5, pp. 24-28) have already discussed and defined the specific limits of *Barbus khudree* and from the material that has recently become available from the type-locality it is clear that this is the Mahseer of the Poona Waterways. Though the form varies to some extent with age, its general resemblance to *B. mosal* (Hamilton) is very striking. As pointed out above, in a number of specimens of all sizes the lateral sides of the snout are covered with a patch of small, rather indistinct, tubercles and it was this character which led Annandale (I, p. 135) to divide young specimens from the Kistna river into *B. mussullah* with tubercles and *B. tor* without tubercles. The presence or absence of tubercles may be a secondary sexual character, but the material available is not sufficient to elucidate this point.

According to Sykes, the anal, ventral and pectoral fins of *B. khudree* are tipped with blood-colour, but 'The same fish, under varied circumstances of age, has the fins tipped with bluish instead of red'. Dr. Suter, who has seen many hundreds of Mahseer from all the rivers of Poona and its environs, informs me that he has never caught a specimen of *B. khudree* having the fins tipped with red. It is probable that in this region only young specimens up to 10 inches in length have the fins tipped with red while the fins are bluish in older individuals. According to Dr. Suter, 'the fish attains a much larger size than the limit of 1½ feet mentioned by Sykes, mahaseer up to 35 lbs. and over having been caught here on many occasions and fish over 30 lbs. are caught every year in the Mutta-Mulah river at Kirkee in the hot weather on balls of atta (wheat flour)'. These fish are known to reach a weight of

50 lbs. However, in a colour sketch of the Khudree Mahseer collected from Mysore by Messrs. Van Ingen & Van Ingen and sent to me by Mr. S. H. Prater of the Bombay Natural History Society the colouration is similar to that described by Sykes. I take the present opportunity to reproduce it here. I shall deal later with the sketches and specimens of *B. khudree* received from Dr. Suter. It may, however, be pointed out that the vernacular name 'Khudree' is not very helpful in determining Sykes's *B. khudree*, since *Barbus sarana* (Ham.) is called 'Lal Puree Khadree' and *B. jerdoni* Day 'Sufed Puree Khadree'. Though both these species possess 4 barbels, the dorsal spine of the former is serrated while that of the latter is weak. Basing his identification on colouration, Dr. Suter is inclined to regard *B. khudree* as identical with *B. sarana*, but Sykes's three species of Barbels were characterized by the possession of a smooth spine, and the allied species with a serrated spine were included by him in other genera.

ACKNOWLEDGMENTS.

It gives me great pleasure to acknowledge with sincere thanks the help I have received from Dr. M. Suter in elucidating the probable systematic position of Sykes's species of *Barbus*. My thanks are also due to Mr. K. S. Misra who helped me in various ways; in fact the suggestion that *B. mussullah* may be identical with *B. curmuca* came from him in the first instance. The Bombay Natural History Society has borne the entire cost of the illustrations and for this I am indebted to the authorities of the Society. For the colour sketch of the Mahseer from the Bhavani River and for several other courtesies, I am obliged to Mr. S. H. Prater.

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EXPLANATION OF PLATES.

PLATE I.

A colour sketch of *Barbus (Tor) khudree* Sykes.

The drawing was made from a specimen collected at Poona, while the colours were taken from a sketch made by Messrs. Van Ingen & Van Ingen of Mysore of a Bhavani River Mahseer 4 feet 9 inches in length and 90 lbs. in weight.

The general colour is mauvish neutral above and silvery below; each scale is provided with a black margin and golden line in the middle. The sides of the head are marked with pale gold or pale greenish gold colours and the iris is golden silvery. The ventral surface of the head is bright silvery-white. The pectoral, pelvic and anal fins are pinkish while the dorsal and caudal fins are pinkish red.

PLATE II.

Copies of Sykes's drawings of *Barbus mussullah* and *B. kolus*.
a, *Barbus mussullah* Sykes; *b*, *Barbus kolus* Sykes.

SOME COMMON INDIAN HERBS WITH NOTES ON THEIR ANATOMICAL CHARACTERS.

By

M. SAYEEDUD-DIN,

Prof. of Botany, Osmania University, Hyderabad Deccan.

(With three plates).

(Continued from page 818 of Vol. xlii, No. 4).

¹ IX.—NICOTIANA PLUMBAGINIFOLIA Viv.

(**Solanaceae**).

SYSTEMATIC DESCRIPTION.

Nicotiana plumbaginifolia Viv., Elench, pl. Hort. Dinegro, 26, t. 5; H.F.B.I., V. iv, 246; Mayuranathan, Fl. Madras City, 201; Sayeedud-Din, Common Fl. Plts. Hyd., 67; Kashyap, Lahore Dist. Fl., 182.

An erect annual branched herb attaining a height of about 2 ft. All parts covered with sticky glandular hairs. Lower leaves forming a rosette at the base, elliptic-lanceolate with entire margin and obtuse apex, reaching up to 10 in. in length (in some specimens these are not present); upper leaves lanceolate, more or less acute, up to 4 in. long, margin wavy. Flowers in distant racemes at the end of branches. Calyx about $\frac{1}{2}$ in. long, segments 5 or more cleft to more than half the length of the calyx, triangular-lanceolate, acuminate. Corolla narrow, salver-shaped with a long tube, linear, light pink, about $1\frac{1}{2}$ in. long, lobes 5, lanceolate-oblong. Stamens 5, attached to the corolla-tube; anthers opening by pores; pollen grains ellipsoidal. Ovary superior, 2-celled, with axile placentation. Fruit an ovoid capsule with many seeds (Plates I & II). Flowers during the rainy season between Aug. & Nov. It flowers from Aug. to April in Madras, and from Feb. to June in the Punjab.

HABITAT.

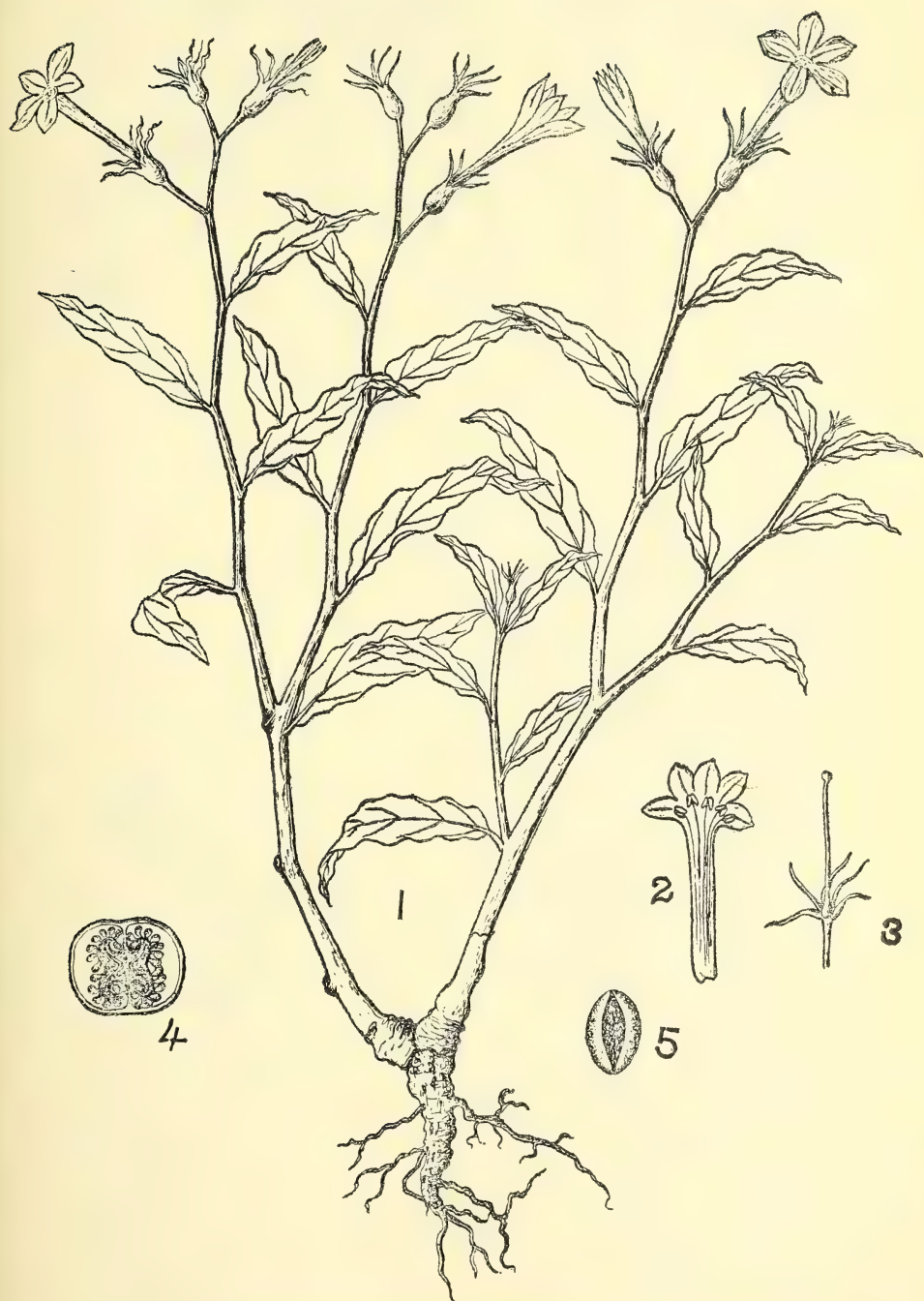
This plant was evidently not found in North India when Stewart (15), Collett (2), and Bamber (1) wrote their floras, nor was it to be met with in Western India when Dalzell (4), Cooke (3) and Nairne (11) took up their floras. Hooker (7) records it and mentions that 'it is the only species of *Nicotiana* that has established itself in

¹ As the galley proof of this paper was being corrected I was reminded of a reference to this plant by M. B. Raizada who mentions that this plant is a weed of waste places in Dehra Dun and several other localities within the area (*J.I.B.S.*, V. xv, No. 2, p. 163, 1936).



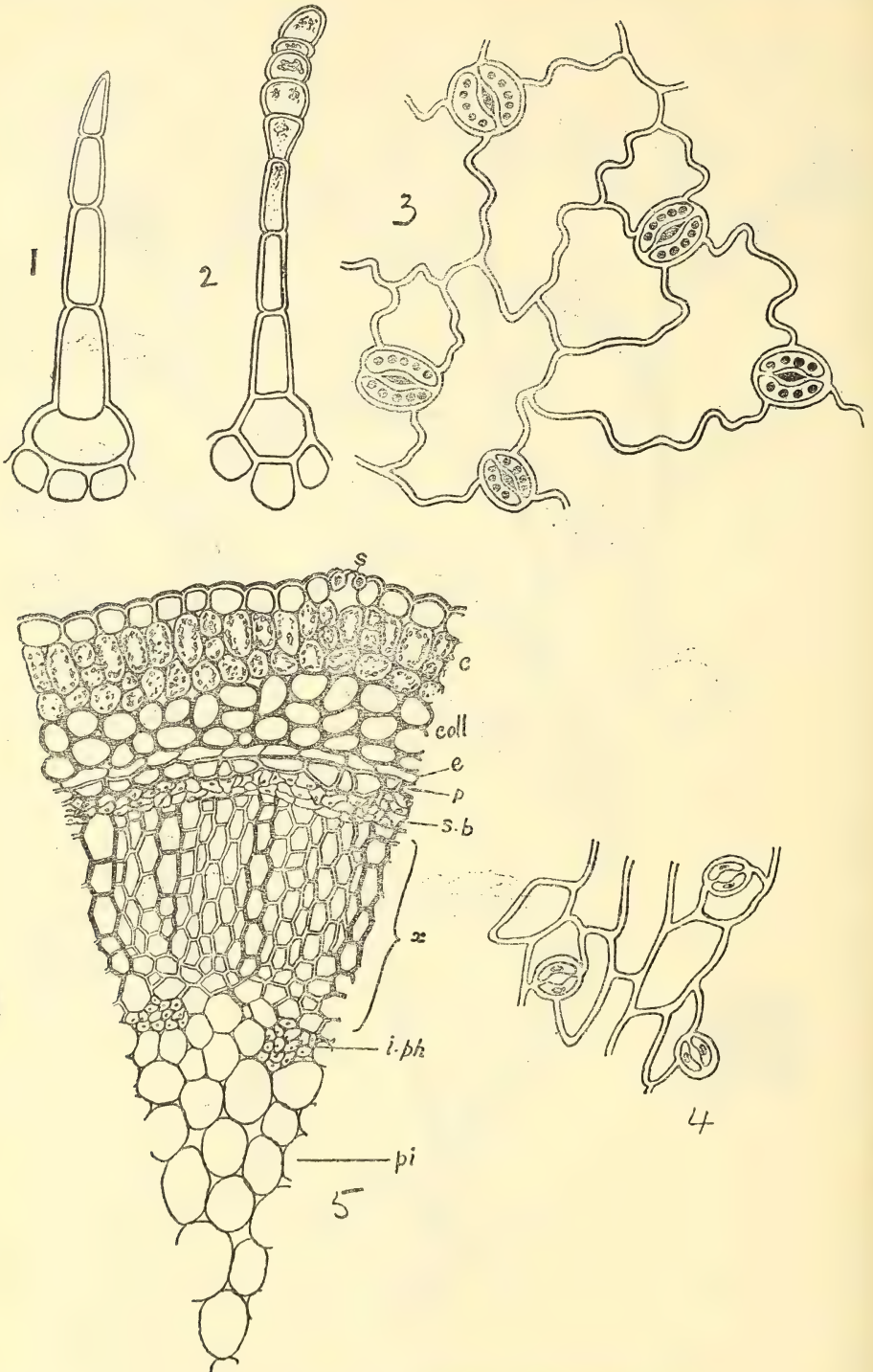
Sayeedud-Din.—*Nicotiana plumbaginifolia* Viv.

For explanation see end of article.



Sayeedud-Din.—*Nicotiana plumbaginifolia* Viv.

For explanation see end of article.



Sayeedud-Din.—*Nicotiana plumbaginifolia* Viv.

For explanation see end of article.

India'. Even Gamble (6) does not record it as growing in the Madras Presidency, while Mayuranathan (10) in his more recent publication mentions it as growing along roadsides in Egmore, and remarks that it has become thoroughly established in the city. The other references are by Sayeedud-Din (13) and Kashyap (9). The author first found it in 1934, growing near a gutter, and subsequently it was found in many moist spots. Kashyap remarks that "it is a common introduced weed. It first came to Bengal but has now spread all over northern India from Assam to Punjab."

Distribution: A native of Mexico and the West Indies, naturalized in Bengal, Punjab and South India.

ANATOMICAL NOTES.

Structure of the leaf. Leaves are bifacial. Stomata occur on both sides of the leaf, but are more numerous on the lower side. They are surrounded by three or four ordinary epidermal cells, and develop according to the Cruciferous type (according to Vesque—Solereder, 14). (Plate III, Fig. 3).

Oxalate of lime occurs in the form of crystal sand and solitary crystals of varied shapes. The occurrence of crystal sand in the genera *Solanum* and *Lycium* has been recorded by Sabnis (12).

The hairy covering consists of ordinary clothing and glandular hairs which are present both on the leaves and the stem. The ordinary trichomes are simple, uniseriate, and provided with a pointed terminal cell. The glandular hairs consist of a stalk of varied length and an ellipsoidal head divided into several (usually 2 to 4) cells by horizontal walls only. The head contains dense contents (Plate III, Figs. 1 & 2).

Structure of the stem (Plate III, Figs. 4 & 5). Stomata occur on the epidermis and are surrounded by ordinary epidermal cells as in the leaf. In the young stem the cortex contains chlorenchyma differentiated like palisade tissue, and collenchyma. The presence of intraxylary phloem is very characteristic, but it is not accompanied by sclerenchymatous fibres as in other genera. Isolated groups of bast fibres are present in the pericycle. The vessels have simple perforations. The medullary rays are uniseriate and narrow. An endodermis is present. The pith consists of unligified cells. In the old stem development of cork has been noticed. It is sub-epidermal in origin, and consists of thin-walled cells with wide lumina, and includes scattered groups of stone-cells.

Structure of the petiole. The vascular system consists of a bi-collateral arc of xylem and phloem.

Many of the observations tally with those recorded by Solereder in other species of *Nicotiana*, and by him and Sabnis in other genera and species. This shows that many of these features are characteristic of Solanaceae.

The following are the chief anatomical features of *Nicotiana plumbaginifolia* Viv.:

1. Stomata are surrounded by three or four ordinary epidermal cells.
2. The development of cork is sub-epidermal. Cork includes stone-cells also.

3. The hairy covering consists of ordinary uniseriate trichomes, and stalked glandular hairs. The latter consist of a stalk and an ellipsoidal head divided by horizontal walls only.

4. Oxalate of lime occurs in the form of crystal sand and ordinary solitary crystals.

5. In the stem occurrence of intraxylary soft bast is characteristic. Besides this, palisade-like chlorenchyma and collenchyma occur in the cortex.

6. Petiole contains a bicollateral arc of xylem and phloem.

ACKNOWLEDGEMENTS.

I am thankful to Mr. Sri Ramloo for the preparation of the drawings, and to my pupils for preparing the slides.

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EXPLANATION OF PLATES I-III.

PLATE I.

Photograph of *Nicotiana plumbaginifolia* Viv.

PLATE II.

- Fig. 1. Black and white drawing of a young plant of *Nicotiana plumbaginifolia* Viv., after removing the side branches (Nat. size).
 Fig. 2. Corolla opened out ($\times 1$).
 Fig. 3. Pistil with calyx attached ($\times 1$).
 Fig. 4. T. S. Ovary ($\times 10$).
 Fig. 5. Pollen grain ($\times 150$).

PLATE III.

- Fig. 1. An ordinary trichome ($\times 150$).
 Fig. 2. A glandular hair ($\times 150$).
 Fig. 3. Leaf-epidermis, showing stomata ($\times 300$).
 Fig. 4. Stem-epidermis, showing stomata ($\times 150$).
 Fig. 5. T. S. Stem, showing s, stoma; c, chlorenchyma; coll, collenchyma; e, endodermis; p, pericycle; s.b., soft bast; x, xylem portion; i. ph., intraxylary phloem; pi, pith. ($\times 300$).



A BRACE OF "GRANDMOTHERS". 55 and 75 pounds.
taken at the famous Confluence N. of Myitkyina.

CIRCUMVENTING THE MAHSEER AND OTHER SPORTING FISH IN INDIA AND BURMA.

BY

A. ST. J. MACDONALD.

(With 1 plate and 2 text-figures).

PART I.

INTRODUCTION.

It is chiefly because I have been pressed by friends, both through the press and directly, and that the last book published on Indian fishing is eighteen years old (*The Mighty Mahseer* by Skene Dhu) that I am attempting to write this account. A series of articles on the 'Game Fishes of India' by Dr. S. L. Hora is being published in this *Journal*. It is written mainly from the scientific aspect and is directed to provide accurate information about the status and distribution of Indian Game Fishes. If one is to write about 'Mahseer', one should in the first instance know what species of fish one is writing about. At present we do not know how many different species of fish are included under the name 'Mahseer'. Dr. Hora's work is directed to unravel these and other problems. The present work deals with the subject, purely from the fisherman's point of view. It has been my intention to write chiefly for the young angler, and for those with less experience than my own, and to provide all the information required without having to purchase for a start the other books published on fishing in India.

For this reason I have included much that would appear unnecessary to the possessor of the *Rod in India*, or other works. I have tried, further, to include here information which has not been dealt with previously, but which will be of interest to anglers in general.

I have refrained from giving long narratives of fights with fish, or large bags made; these are beside my object. I wish to see ten rods fish in the place of one, and to encourage the study of the mahseer.

I will ask the reader to bear in mind these aims. What I have written is written by an angler for the angler. I offer little to the experienced, merely the point of view of the individual. My aim is to help some to catch more fish than they already have done, and to others to start at the beginning. This work does not presume to have any literary value, or any interest outside the subject to which it is devoted. It is an endeavour to impart knowledge of the subject, to those prepared to accept my simple expression based on experience, of the best ways to master the many aspects of angling in India and Burma.

I offer my advice for what it is worth, so that it may be a guide and help in starting you off on an angling career to obtain sport as good as any in the world; for a fish that takes two to

three minutes per pound to kill, on fly rod and light tackle, cannot be despised by any angler. I refer of course to the mahseer, to which this book is chiefly devoted.

Eighteen years is a long period of time to cover. From the angler's point of view, much of the water that was good has been spoilt either by canal systems or development; but there is still plenty of scope for the keen angler, and sport is as good. I have perhaps neither the qualifications nor the experience of many others in the country today, but I have waited 18 long years for a lead and to all of you whose experience outweighs my own, this is my answer!

Nine years ago I was approached, as I have already said, to write a book on fishing; after much correspondence and trouble I got it compiled. I derived a great deal of pleasure in doing so, but the publishers fought shy, as the expense of publication would not, in their opinion, be covered by the demand for such a book in India and Burma. It was full of maps, sketches, and photographs, but not any more than a book by a plant hunter or big game writer. Why big game in India can stand so much publication (almost a book or two a year), and fishing not one in 18 years I fail to understand. Especially as there is almost a boring repetition of facts appearing in recently written shikar books; nor can it be that for every man keen on big game less than one in eighteen is an angler! However, the fact remains that the book was not published. Now, to meet the still pressing demand, I have cut down maps, sketches and photographs to a minimum; and to keep within the limits of publication, and publishers fears, I have condensed the original book into 250 pages of twelve chapters.

The chapter on practical Natural History, which is in a strict sense not about natural history as the 'giants' know it, but a simple and straightforward way of studying fish for purposes of identification, should not deter the reader who need have no fears of being bored by long lists of Latin names and technical definitions. There is nothing in this chapter with which a good angler should not be familiar.

I am indebted to Dr. Sunder Lal Hora, Director of Fisheries, Bengal, and Dr. T. J. Job for kindly going through and rearranging the chapter, and to Dr. Hora's artist for the excellent labelled drawings of the Putitor Mahseer.

I have also dealt with the scientific aspects of angling not hitherto touched on by any of the writers on Indian fishing; in fact there is much in contradiction to their interpretation of the senses of fish, and their reaction to artificial lures. In order to elucidate the practical interpretation of the senses of a fish it has in the first place been necessary to quote freely from the world authority, Norman, and others, so as to acquaint the reader with facts about fishes not generally understood, and which do not ordinarily come his way. The practical application of the senses as applied to angling are of course my own, based on individual experience. Only a practical test will convince the angler whether my interpretation is right or wrong.

Hints to the Novice on the subject of tackle, with aids to its selection from confusing price lists and catalogues; a few general

remarks on casting with fly and spinning rod; the points to remember while playing a fish; where to look for fish; with a few suggestions on kit and the conditions likely to be met with on a fishing trip have been included. Most of these are dealt with again, and in more detail.

The subject of 'Tackle for Mahseer' has been subdivided for purposes of convenience into heavy, light, and medium fishing. More detail has been given in dealing with the selection of tackle, the tying of traces, knots, mounting spoons, etc.; and there is a list of a few tackle dealers in India.

'Fishing for Mahseer', covers a fairly wide field, embodying all the many aspects and considerations likely to influence the angler and fish; with a sketch map of a stretch of river, 'lettered' to assist in recognising good water. Most of the chapter is devoted to spinning for mahseer; but gram, paste, and dead bait fishing are also discussed. I propose to include a short account dealing with the 'Other Sporting Fish' and how to circumvent them. It has plates of most of the commoner fish likely to be taken. I have devoted some attention to Burma, giving full page illustrations of six forms of mahseer I caught, with details of the colouring, which should be found interesting; also full notes of bags and sizes of fish taken around Myitkyina. The account of fishing in Assam, is a reproduction of letters and notes kindly sent me by the many sportsmen and anglers with whom I got in touch, through the curators of the Bombay and Darjeeling Natural History Societies. The plates of the teeth of mahseer and carp, are most interesting and instructive.

'Tank angling', is dealt with briefly, and has two valuable notes on Cutla fishing.

'Sea and estuary Fishing', gives sufficient reference to guide those interested to good sport.

In 'Scraps from my Note Book', will be found general information necessary and useful to all fishermen.

If this series of articles justifies my conviction that there are more anglers in India than publishers imagine, a full and up-to-date book might follow.

I think, myself, that this is an unsuitable time to publish a book, but it has compensations for those of us who have had 'cold water' thrown on all our efforts to join the Forces, and to the many civilians and soldiers whose lot it is to stick it out in administrative posts which have to be held in times such as these.

In conclusion, I take the opportunity of thanking all those anglers, who nine years ago so readily responded to my requests for notes, and went to the trouble of making maps and sending photographs. I hope that at no great distant date these will prove useful in a book on Localities.

To the tackle dealers I tender my apologies should I have unduly criticised goods; it is with no intention of disparagement but solely to illustrate my point, and to improve tackle generally.

To the critic! This is a beginning; yours is the last word! The substance of these articles is based on good bags and results; if you can offer better, I shall be the more pleased.

I. MAHSEER FISHING AS COMPARED TO OTHER SPORT.

Children angle for minnows with bent pin and cotton thread, big game sea fish are captured by their parents with specially devised rods and appliances. Each in its own way provides the sport that is sought.

As I am dealing with mahseer chiefly, and other fishing generally, it will suffice for the present to write a few words as to what mahseer fishing really means.

The mahseer is essentially a fish of the rocks, the rapids, and the hills. In his quest for this fine fish the angler is taken into wild surroundings amidst some of the finest of nature's scenery. It may be that he will find his sport in the Himalayas, where is the grandest scenery in the world, and where the turbulent river winds its way through dark gorges clad in fir groves and rhododendrons, with perhaps a glimpse at the head of the valley of the Eternal Snows—the stainless ramps of huge Himāla's wall', where the snow-fed torrent has its sources; or perhaps he will be wielding his trout rod amid the charming scenery of the valleys of Kulu or Kashmir.

The scene, again, may be along the banks of rivers in Garhwal or Kumaon, where the deep gorges are most oppressively hot, or in the lakes of Kumaon in a lovely climate. Then perhaps his efforts may lie in southern India, the yet secure home of elephant and bison, where unknown and almost impenetrable forests rise like a wall from the banks of the stream, and in which even people of the aboriginal tribes can become lost amid the tangle of mountains and vegetation; or it may be that he is wandering along the many streams of the Western Ghats, in enjoyment of the marvellous scenery peculiar to the favoured climate of Mysore.

A few days in a ship or train, and the fisherman can be in Burma or Assam, in pursuit of that monster mahseer of his dreams, which he will perchance find at the 'Confluence', or in one of the tributaries of the mighty Brahmaputra. In those lands the waters beloved of the noble mahseer are fringed by giant bamboos waving their graceful fronds over the placid depths, or by splendid trees whose immense serpentine roots are washed by the roaring rapids. There will be the dense retreats of the wild elephant, the secure cover for bison and other game, the last barrier put up by long-suffering nature against the ever destroying hand of man.

In the upper story of forest trees, growing straight and tall, their branches wrapped in mosses and orchids and fringed with ferns, the gibbons sport and play. Often will their far-sounding cries be heard, but seldom will the animals be seen; so with the birds which call and twitter in the jungle thickets, and so with the peacock, pheasant, jungle fowl and all the life in those teeming evergreen forests. In the few open spaces and at the crossings of the streams, will be those swarms of fluttering butterflies of gorgeous hues which congregate at such places; and strange little flowers peep timidly from amongst the vegetation which smothers all the land.

Shooting, fishing, painting, photography, are all in abundance for those who will venture into the wild places where pursuit of the mahseer will lure them. The thrill of a big mahseer, hooked in heavy water, hurling himself down the rapid with express speed to the tune of a fast emptying reel, has an electric joy apart from any other sport. There is nothing quite like it; and once experienced it is imprinted for ever on the tablets of memory. Many a sportsman has truly said that he would rather catch a big mahseer than shoot a tiger.

I have been fortunate in enjoying many of the varied kinds of sport obtainable in India; and, were I given to comparison, would place mahseer fishing second only to pig-sticking. The days available to the votary of the spear are all too short, for, with the passing of the years age must give way to youth; but at least we can fish while health and eyesight last.

It is not perhaps fair to make comparisons. The whirr of a rising partridge, the swoop of a flighting duck, the call of the Koklas pheasant, or the gorgeous Monal as he hurtles through the pines; the mad gallop with the bobbery pack in pursuit of fox or jackal, the yet more reckless pursuit of the great grey boar; is each in its own place akin to that heart-beat when the driven tiger approaches the waiting sportsman, with that moment when at last one closes into action with the elephant or bison tracked since dawn. At all such times one is spellbound by the intense enjoyment of the moment; but the instant of contact with a heavy mahseer, he of the two or three score pounds, in the racing rapids of a river, is a thrill unsurpassed in any other sport.

The varied joys and excitements of a fishing trip in wild places are a panacea for all worldly cares and troubles. The quest of the mahseer will take the young soldier, or civilian, or those many others who are entering into various walks of life in the East, among wild places and peoples where will be gained that self reliance and poise of character which is the outcome of responsibility. In close contact of the many varied people of the land will much knowledge be gained which can be acquired in no other way.

Fishing is a sport which can meet many tastes and pursuits. The painter, the hunter of big game, the entomologist, the botanist, the ethnologist, in fact all the ologists will find interest and refreshment apart from the actual fishing; there, also, will be found that solitude in communion with Nature which is the Mecca of all lovers of wild life.

It is to Burma in particular that my love is given. The wild scenery, the giant trees, the multi-coloured orchids, the birds and butterflies of brilliant hues, and above all the pleasing and cheerful people—the Burmese and Shans, the Chins and Kachins, attract me in a way apart from the fascinations of other countries in the East.

Have I dwelt too long upon the joys and attractions in the quest of the mahseer? In what better way can a holiday be spent than in pursuit of the elusive *Barbus tor*? It has been my endeavour in the following chapters to provide the answer.

II. SIMPLE NATURAL HISTORY OF THE MAHSEER.

In this chapter I am merely endeavouring to put before the angler certain facts that will come within his ken, and aid the making of notes by which he can do much service to Ichthyology and a greatly neglected subject, the study of one of the most sporting fishes in the world, the Mahseer of India and the East. The immortal Thomas, in 1873, 1881 and again in 1897, published the classic 'Rod in India', and other lesser books have followed in its wake. They, however, have been written almost solely with the object of showing the way to sport rather than of combining with fishing the study of the fish that provides that sport.

This much have I aimed at: to show in simple form how to recognize the many varieties of the fish that has afforded such grand sport ever since the British came to India, and of which we still know comparatively very little; and to make notes of interesting points, which often catch the eye of the Angler, but which, alas, seldom receive the attention and publicity which they deserve.

The Angler's part in Natural History.—The Angler can be the best friend of Ichthyologist. Simple notes such as are suggested in this chapter will enable the 'Pundits' to arrive at scientific results; we anglers can be their field naturalists. Observations made intelligently and with that enthusiasm in the subject I am asking fishermen to attain, will be of the greatest value, and most gratefully appreciated by the staff of the Bombay Natural History Society. It takes but a matter of five or ten minutes to note down the necessary details as to any unusual fish (data required will be found later on), and the preservation of a specimen in formalin is most simple. So to all anglers reading what I have written I make an appeal for help in elucidating all that has to be learnt about the Mahseer. Some may say, 'What does it matter whether a fish is a Black, Red or a Green Mahseer? I am out only for the sport, and so long as I get that, I am satisfied'. The answer to that is that to fish for sport only, without a thought to the aid of Science in learning all that there is to know of the fish, becomes mere body-snatching; no true sportsman, once enlightened in the matter, can for long retain that attitude of mind; and should these articles of mine make even a few converts, and result in but a few specimens and notes being sent in to the Society, I would feel it sufficient reward for my labours.

A good deal of what follows I owe to the works of the late H. S. Thomas (1897), of Sir Reginald Spence and Mr. S. H. Prater (1932), of Professor Neilson (1934), of Mr. J. R. Norman (1931) and of Dr. S. L. Hora (1939—).

Most of the fishes of any importance to the angler belong to two families—the Cyprinidae or Carps, and the Siluridae or Catfishes. The Mahseer belongs to the Carp family. But he is very different in size, flavour, strength, activity, and so forth, to his ignoble namesake in England. Hence you had better call him a Barbel. The status of the Mahseer is very much disputed. A number of species seem to inhabit the waters of the Indian Empire. Thomas (p. 27) writes, 'Further experience has confirmed me in

the view advanced in 1873, that there are more Mahseers than have been named, and that if it were possible that as much accurate attention could be given to the Mahseer as has been devoted to the Salmonidae of Great Britain, of Europe, and of America, it would be found that the Mahseers of India would likewise grow in numbers'.

Thomas's prophesy has come true, for, in his recent series of articles on the 'Game Fishes of India', Hora has shown that at least 4 to 5 kinds of Large-scaled Barbels are found in the Himalayan waters.

Popular names.

Mahseer are known by numerous vernacular appellations in different parts of India and Ceylon, such as *Putitor* (Goalpara); *Tor* (Rangpur); *Sāhārā* and *Tūryā* (Purneah); *Māsūl* (Kosi R.); *Kajrā* (Dāūdagar, Sone R.); *Burapatra*, *Junga Peetia* (Assam); *Naharam* (Hindi); *Kukhiah* (Punjab); *Kurreah* (Sind); *Kendi*, *Bōmin* (Tamil); *Peruval*, *Harale-minu* (Canarese); *Hāllāminu* (Mysore Canarese); *Meruval* (Malayalam); *Heragālu*, *Peruval* (Tulu); *Kādchi*, *Barsa Masla* (Marathi); *Kuriah*, *Lela* (Sinhalese). Fishes throughout the world appear to have more local names given to them than any other animal. Various opinions have been expressed about the etymology of Mahseer. Lacy and Cretin (1905, p. 2) observe, 'The derivation of Mahseer from *maha sir*—big head—may be merely an attempt to give a meaning to the word. The derivation from *maha sher*—big tiger—is fanciful, although the natives sometimes pronounce the word 'Mahseer'; it is merely the soft equivalent of the word. A third and a good derivation is from *Massulāh*, *Mahasalka*—big-scaled. The natives often call the fish *Mahsol*. The Mahseer has got bigger scales than any other fresh-water fish in India. Its big scales form one of its most distinctive characters. A big Mahseer has got scales as big as the palm of one's hand, which make the use of the gaff unsafe. The scales are used as playing cards in some parts of India. A fourth, and a likely, derivation is from *Matsya*, which is the Sanskrit word for 'fish', and is used in the Vedas. As the Mahseer is a sacred fish, preserved near many Hindu temples, it is probable that the Brahmans called it 'Fish' *par excellence*, pronouncing the word 'Mahsia'. More recently Hora has dealt with this point exhaustively and is of the opinion that Mahseer is very likely a colloquial form of *Mahāsīrasha* or *Mahāsīras*, the bigness referring to the front part of the fish and not merely to its head or snout.

I propose to describe below how fishes are identified and to give the general features of the Golden or the Common Himalayan or the Putitor Mahseer, *Barbus (Tor) putitora* (Hamilton); pointing out the peculiarities of the other species so far recorded from North Indian and Burmese waters with their geographical distribution.

As with other classes of the Animal Kingdom, Fishes are divided into various sub-classes, orders, sub-orders, families, sub-families, genera, sub-genera and species, the classification being based on resemblances or differences in structure. The cartilaginous fishes, such as sharks, skates and rays, differ so obviously and fundamentally from the bony fishes, that the former are grouped together

in a separate sub-class. But in spite of certain structural resemblances they differ among themselves in certain characters so that this sub-class is sub-divided into an order to include all the sharks, and another to include all the skates and rays. The family is a group of fishes within an order or sub-order, possessing certain general features in common. Different members of a family, in accordance with particular affinities, are grouped into separate genera. The members of a genus or even of a sub-genus are themselves distinguished from one another by specific differences, usually indicated in the nature of the teeth and fins, in the number and arrangement of the scales, and other anatomical details. Thus we come ultimately to the species. It has to be remembered that even among the members of a species no two individuals are ever perfectly alike, and minor individual variations are bound to be met with. These, however, are hardly of any specific significance. In scientific nomenclature a fish gets a double name, the first word representing the genus, and the second the species. The name of the author who first described the species usually follows. In certain cases another name is included between the generic and the specific name to signify a sub-genus. Thus the common Himalayan Mahseer is scientifically known as *Barbus* (*Tor*) *putitora* (Hamilton), where *Barbus* is the generic name, (*Tor*) is the name of the sub-genus, *putitora* is the specific name, and the fish was first described by Francis Hamilton. From the foregoing account it will be seen that the classification and identification of fishes is based on resemblances or differences in their anatomy. An attempt is made here to explain with special reference to the Mahseers the main external characters on which the differences are based, and some of the terms and abbreviations commonly used in scientific descriptions of fishes.

Form of body.—Fishes are usually boat-shaped, being longer than broad or deep, and adapted for swift movement in water. Variations from this typical form, however, are not rare. The body of a Carp is said to be compressed, *i.e.*, flattened from side to side, while that of a Catfish is said to be depressed, *i.e.*, flattened verti-

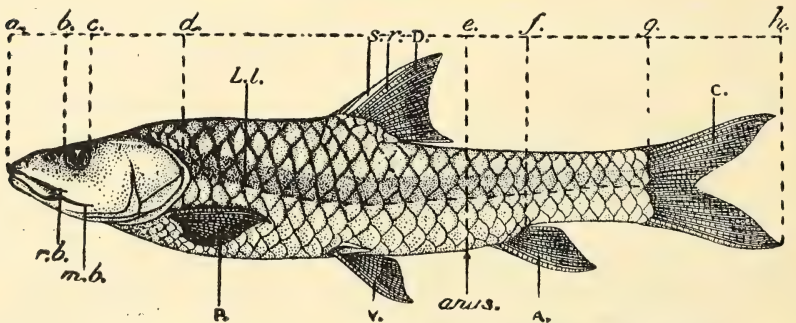


Fig. 1.—The Putitor Mahseer, *Barbus* [*Tor*] *putitora* (Hamilton).

(For explanation see page 188).

cally. The Putitor Mahseer (fig. 1) is an oblong, somewhat compressed, streamlined, trout-like fish in which both the profiles are gently and gracefully arched. The head is broadly pointed anteriorly

and behind the anal fin the tail becomes considerably narrow. The gape of the mouth does not extend to below the eyes; it is horizontal with the opening obliquely directed upwards.

The lips are fleshy and continuous at the angles of the mouth; the lower lip (Fig. 2 *b*) is produced into a median lobe and the post-

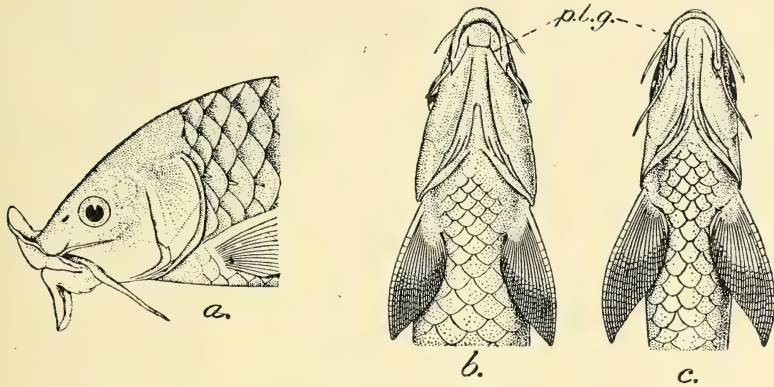


Fig. 2.—Oral features of Mahseers.

(For explanation see page 188).

labial groove (*p. l. g.*) is continuous. The condition of the lips varies greatly in individuals of different sizes and in those collected from different localities. It is highly desirable that anglers may kindly note the condition of the lips of the Mahseers caught by them and also make a detailed note of the length.

Body proportions.—Fishes, as a rule, continue to grow as long as they live, and hence the actual length of a specimen is of very little significance in its identification. But the relative lengths of the different parts of a fish remain constant. The body proportions may vary in young specimens, and therefore the measurements of fairly adult specimens are reckoned. The *total length* of a fish (fig. 1 *ah*) is measured from the tip of the snout to the end of the tail fin. The *length of body* or *standard length* (*ag*) is the distance from the tip of the snout to the origin of the tail fin. The *length of head* (*ad*) is the length from the tip of the snout to the hind margin of the bony part of the gill cover. The *depth* is the vertical distance between the dorsal and ventral surfaces at the deepest part. The *diameter of the eye* (*bc*), the interorbital distance; length of snout (*ab*), i.e., the portion of the head in front of the eye; the *length of caudal peduncle* (*fg*), i.e., the distance between the last ray of the anal fin and the origin of the tail fin; the *least height of caudal peduncle*, etc. are also measured. The girth of the fish is the measure round the stoutest part. The tail (*eg*) in the scientific sense is the portion of the body behind the anus, though in the popular sense the tail may include the tail fin also.

In a scientific description of *B. (Tor) putitora*, one reads as follows:—The length of head is contained from 3 to 3.6 times in the standard length. Depth of body is contained from 1.1 to 1.4 times in the length of head. The diameter of the eye is contained

from 2.8 to 5.3 times in the length of head, from 0.8 to 1.7 times in the length of snout, and from 0.7 to 1.4 times in the interorbital distance. The least height of the caudal peduncle is contained from 1.4 to 1.8 times in its length.

Fins.—According to the position the fins of fishes come under two categories: the paired fins and the vertical fins. The paired fins consist of a pair in the fore part of the body, one on each side, called the pectorals (P) and a second pair below the pectorals, on the lower surface of the fish, called the ventrals (V) or pelvics. In some fishes either or both of these may be absent. The fish uses the paired fins mainly for balancing itself in water. The vertical fins are the dorsal (D) on the middle line of the back, the caudal (C) or tail fin and the anal (A) in the middle line of the belly. The tail and its fin constitute the chief swimming organ of the fish. The bony rays which support a fin may be either simple or branched and articulated (composed of numerous branched joints which render the fin flexible). Simple rays are called spines (s), while the others are described as soft rays (r). Some spines may be soft and flexible, but they are distinguishable from true soft rays by their plain unbranched nature.

Thus the fin formula of the specimen of the Himalayan Mahseer figured here as:—D. 4/9; A. 8; P. 17-18; V. 10; C. 19 indicates that the dorsal fin has 13 rays of which 4 are spines and 9 soft rays; the anal has eight rays; the pectoral has 17 to 18 rays; the ventral has 10 rays; and the caudal has 19 rays, all soft. In the Himalayan Mahseer the commencement of the dorsal fin is opposite to that of the pelvics, and is almost midway between the tip of the snout and the base of the caudal fin. The last spine is very strong and bony; it is generally shorter than the depth of the body below it, but in some individuals it is equal to the body height. In a specimen from Murree, however, it is considerably longer than the depth of the body. The pectoral fins are low, considerably shorter than the head and sharp above. The pelvic fins do not reach the anal opening. The anal fin does not extend to the base of the caudal fin. The caudal fin is sharply divided, with the lower lobe somewhat more pointed' (Hora, 1939, p. 278).

Scales.—The skin of fishes is either covered with scales or naked. Some parts like the head and fins are more often naked than scaly. Scales of fishes are horny elements developed in grooves or pockets of the skin like hairs, nails or feathers of the higher vertebrates. Scales as those of carps, with an entire hind margin and a concentric striation are described as cycloid. The number of scales along the lateral line, as also the number of rows of scales above and below the lateral line, are often of specific significance.

Lateral line (L.1) is the line of perforated scales running along each flank of the fish. Beneath each pore is a group of sensory cells which perceive the slightest pressure changes in the surrounding water. The lateral line has nerves connected with the ear of the fish. The scale-counts in relation to the lateral line of *B. (Tor) putitora* are represented as follows:—L. 1. 25-28; L. tr. $4\frac{1}{2}/2\frac{1}{2}$. This signifies that there may be from 25 to 28 scales along the lateral line; L. tr. represents the number of transverse rows of scales between the middle line of the back and the ventral fin, and

in this case there are $4\frac{1}{2}$ rows above (up to the base of the dorsal fin) and $2\frac{1}{2}$ rows below (up to the base of the pelvic fin) the lateral line. The numbers of scales between certain other landmarks of the body also are sometimes taken into account. Thus in the Putitor Mahseer there are 9 scales before the dorsal fin (up to the head) and 12 round the caudal peduncle, and there is a well developed scaly appendage in the axil of the pelvic fin.

Barbels.—In some fishes as in carps skinny appendages called barbels or feelers occur on the jaws. According to their position they are described as *nasal* from the region of the nostril, *rostral* from the snout, *maxillary* from the upper jaw, usually at the corner of the mouth, *mandibular* associated with the lower jaw and *labial* associated with the lips. The Putitor Mahseer has two pairs of barbels, one rostral (*r. b.*) and the other maxillary (*m. b.*), which are more or less of equal length.

Age.—The condition of the scales and otoliths is said to indicate the age of a fish. Definite growth rings have been detected in the scales of European fishes like the salmon. But the technique is still undeveloped in the case of Indian Carps. To be able to say anything definite, it is desirable that large numbers of fish of different species in diverse waters be examined in detail and systematic observations made on their scales to elucidate the significance of the rings. The ear sacs containing the otoliths are situated on the sides of the base of the skull. The otolith is a bony concretion and increases in size during the entire life of the fish, each year adding two layers, a light one formed in summer and a dark one in autumn and winter. The number of pairs of layers represent the age of the fish. Here again, variations may occur, and the technique has yet to be perfected in the case of Indian fishes.

Sex.—Fleshy protuberances and hypertrophied lips (fig. 2a) have been suggested to have a sexual significance; but those characters are not reliable, and the crucial test is an examination of the gonads. But if it is difficult to be sure whether it is an ovary or a testis, the same may be preserved and sent, with other particulars, to the Bombay Natural History Society for further study.

The gonads occur as a pair of elongated, light-coloured, strap-shaped bodies lying one on each side of the intestines, and lodged in the groove between the air-bladder and the abdominal wall. Each gonad appears as a quill-like bag, which in the female shows little rounded dots of eggs which are absent in the male.

Colour.—There is a variety of colours among the different Mahseers, and even in the same species the colours vary considerably according to the nature of the waters inhabited by the fish. Here is Hora's description (1939, pp. 278, 279) of a nine-inch long specimen of *B. (Tor) putitora* freshly collected from the Tista river near Washabari Bazaar in the Eastern Duars:—

'The dorsal surface of the head and a small anterior portion of the body were found to be of a Lincoln green colour while the ground colour of the remaining portion of the dorsal surface of the body was warm buff which faded into light pink at the sides and silvery white on the ventral surface. On the sides, between the upper angles of the gill-openings and the base of the caudal fin, there were broad bands of light mineral gray. Each scale was

anteriorly marked with a gray blotch. The portion of the tail in front of the caudal fin was marked with an irregular, broad, vertical band of amber yellow. The operculum and the sides of the snout were of gray colour while patches of orange and yellow colour were present on other parts of the head. The dorsal fin was light yellow in colour while its rays were conspicuously yellowish gray. The fin was provided with a broad band of mineral gray across the rays. The pectoral fins were pink at their bases and citron yellow distally. The pelvic fins were yellowish with a tinge of pink at their bases and extremities. The anal fin was likewise citron yellow with pink extremity. The caudal fin was also citron yellow with its rays of mineral gray colour; it was edged with pink and gray.

He further describes a $3\frac{1}{2}$ feet long specimen of the same species collected from another region of the Tista river and kept in a *kachha* tank at the Rungli Rungliot Tea Estate, Darjeeling District, as follows:—

'The back was reddish sap green and along the sides above the lateral line there was a broad band with a purplish shadow throughout. Below the lateral line the body was light orange which faded into silvery white on the belly. The head below the level of the eyes was light buff yellow which was replaced ventrally by a light neutral tint. The iris was light green while the pupil was dark blue. The scales in the upper half of the body were marked anteriorly by reddish sap green colour while in the centre they were brilliantly orange, their posterior edges were peacock green in colour with shades of light and deep sap green anteriorly. The pectoral, pelvic, anal and caudal fins were peacock green in colour; the distal tip of the anal was marked with a patch of reddish orange, while the posterior border of the caudal fin was marked with reddish green. The tubes on the lateral line were greenish silvery.'

The best way to paint or draw a Mahseer would be to keep by one's side three or four sketches of the Mahseer in outline, keep the fish alive in the water beside you, and as the colours of the fish are noted down, put it back for a breather. In this way the most accurate notes can be made. If you put him on the bank alive, he will start changing colour almost noticeably, and by the time you have worked back to your first notes, the colour will have changed.

The resplendent hues of living fish are inimitable; you can almost see the changing hues and sheen-like colouring fade with the life of the expiring fish.

Notes, even though rough, and the colours approximately close to those of the living fish, are always valuable. Time in carrying out this difficult task is never wasted. As per Formula below.

Formula for Field Notes on Mahseer Catches.

- I. Locality, date and time of catch with notes on the habitat.
- II. Colour notes with special reference to the colour of the back, sides, belly, tail, cheeks, fins.
- III. Body form and other general features, such as condition of lips, barbels, etc,

IV. Body proportions and weight :

Total length, Length without tail fin, Length of head, Depth, Girth.

V. Scale count :

Along lateral line, Above lateral line to beginning of dorsal fin, Below lateral line to beginning of pelvic fin.

VI. Sex; Condition of gonads: immature, fairly mature, full or spent.

VII. Food :

Gut-contents, items and their approximate proportions, such as insects 60%, molluscs 25%, aquatic plants 10%, indistinguishable, digested matter 5%.

BIONOMICS.

Food and feeding habits.—The Mahseer is noted to be an intermittent feeder. Green filamentous algae and other water plants, slimy matter encrusting rocks, insect larvae, etc. have been recorded from the stomach-contents of the Putitor Mahseer. Thomas, discussing the food of the Mahseer, observes:—

'Aquatic weeds of all sorts, some taken intentionally, some when grabbing at the insects that live on them; seeds of the *Vateria indica* or Dhup of the West Coast, which are about the size of a pigeon's egg; the seeds of many other trees also which hang over the river where it is forest-clad; bamboo seeds; rice thrown in by man; and unhusked rice, or paddy as it is washed from the fields; crabs . . . , small fish, earthworms, water beetles, grasshoppers, small flies of sorts, water or stone crickets, shrimps, and molluscs or fresh-water snails are also found there, the latter shell and all, and smashed to pieces like the crabs.

'Of all this category the easiest food for the fisherman to present in a natural form is a small fish, or imitation fish.

'It will also be observed that the food taken on the surface of the water is little in comparison with that taken under it, and at the very bottom. The fish, beetles, crickets, shrimps are all found well under water; the crabs, worms, molluscs, quite at the bottom; and from the proportionate quantity found in them, the crabs, molluscs and fish seem to be their favourite food.

'This is what Paley would call "internal evidence". But we have also external evidence to the same effect . . . The four fine feelers hanging down, two on each side of the mouth, which give him the scientific name of *Barbus* or bearded (from the Latin *barba*, a beard), are indications of a bottom feeder.

'The upper lip is capable of being extended beyond the lower lip, and brought down to the same level, so as to form a cup on the bottom of the stream, and cover any small body, such for instance as the aforesaid molluscs detached from their hold by their upper lip, and being washed rolling down the bottom of the stream. The molluscs being thus detached and covered, are readily drawn up into the mouth by suction.' The suctorial mouth may also be used for adhesive purposes against the swift torrents.

Whereas in the younger stages Mahseers feed on algae, insects, small fish, etc., middle sized specimens and older ones prefer crabs, molluscs and other hard objects which can be easily tackled by the crushing and grinding pharyngeal teeth, often prized as trophies by the angler, especially as these provide fairly reliable evidence of the size of the specimen caught. These teeth are borne on the pharyngeal bone, which is the well developed fifth gill arch. As the pharyngeal teeth lie in the throat of the fish they are not used in catching or holding the prey, but are employed for tearing and masticating purposes. As the fish grows the teeth are shed individually as they become worn and replaced by fresh teeth that may be found growing in the adjoining mucous membrane.

Examination of the gut-contents of a large number of specimens will reveal the feeding habits of the fish in different waters. The digestive tract of the fish enlarges into an elongated thin-walled bag-like stomach which leads into a long narrow tubular intestine coiled into several loops and opening out at the anus. The liver and other digestive glands are associated with the tract. For purposes of food analysis the gut may be severed at the throat and at the anus, and after making a tiny incision on the stomach the whole, with the contents intact, may be preserved in 5% formalin and sent to the Society.

Migration and spawning.—During the floods the Mahseer ascends considerable heights to gain the upper reaches of the river travelling long distances for fresh feeding grounds and for the purpose of spawning. There they linger till the diminishing stream warns them to be moving downwards. There they lay their eggs in sheltered rock pools, not in the manner of the salmon, all at one time, but a batch of eggs at a time, repeating the process several times in a season. The Putitor Mahseer is said to spawn three times in the year. In the Punjab the three spawning seasons are (i) January and February, (ii) May and June (snow melts) and (iii) July to September (monsoon months).

Other Himalayan Mahseers.—The following key of Hora will be helpful to distinguish specimens over 9 inches of the various Mahseers of established status:

- I. Labial groove interrupted in the middle; lips comparatively thin and never hypertrophied; cheeks covered with tubercles.

Barbus (Lissochilus) hexagonolepis McClelland. The Katli of the Nepalese and Bokar of the Assamese. The Chocolate, Olive, Black or Red Mahseer of Burma.

- II. Labial groove continuous; lips thick and well formed, sometimes produced into adipose flaps; cheeks smooth.

- A. Length of head considerably greater than depth of body.

Barbus (Tor) putitora (Hamilton).

The Golden or the Common Himalayan Mahseer including Greyhound and Thick-lipped varieties.

- B. Length of the head considerably shorter than or more or less equal to depth of body.

1. Length of head considerably shorter than depth of body.
Barbus (Tor) tor (Hamilton).
The Deep-bodied Mahseer.
2. Length of head more or less equal to depth of body.
Barbus (Tor) mosal (Hamilton).
The Copper Mahseer.

Size and distribution of the Mahseers.—The Putitor Mahseer has been recorded by Hamilton to grow up to 9 feet. It occurs all along the Himalayas and probably extends to China. The Lissochilus Mahseer is said to grow over 2 feet in length (a 21 lb. *Katli* has been reported by Holt, 1940). It is the commonest large-scaled barbel of Assam and of the Eastern Himalayas. The Tor Mahseer grows to about 4 feet. It seems to be widely distributed along the foot hills of the Himalayas. It also occurs in the rivers of Assam and the Central Provinces. The Mosal Mahseer may attain a length of 5 feet and appears to be more common in Burma than in the Himalayan streams.

The Black Mahseer.—The Black Mahseer is a case of *melanism* or unusually dense pigmentation. It cannot be regarded as a distinct variety since melanic specimens belonging to different species have been described or figured as Black Mahseer. Several cases of melanism in diverse types of fishes are on record and it is believed to be due to genetic or pathogenical causes. How far environmental factors such as the influences of light, temperature, climate, food, etc. are responsible for melanism is yet to be determined.

To those interested in this subject, and who wish to study it further, I can do no better than introduce them to Shaw and Shebbeare's 'The Fishes of Northern Bengal' and Dr. Sunder Lal Hora's series of articles on 'The Game Fishes of India' appearing in *The Journal of the Bombay Natural History Society* (from Volume xxxix, part II of 15 April 1937 onwards). The first is already available in book form excellently arranged with drawings and photographs of most of the fishes to be found in India, with clear and simple notes, and is easy to follow. Dr. Hora needs no introduction. He is the leading authority on Fish in India, and his articles are of immense value to all lovers of the sport. I look forward to the day when this series will have been completed and published in book form—the fishes illustrated in colour—to take its place by those excellent volumes published by the Society, *The Game Birds of India* etc.

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EXPLANATION OF TEXT-FIGURES.

Figure 1. *Barbus (Tor) putitora* (Hamilton).

- (1) a-d. Length of Head.—(contained 3 to 3.6 times in standard length. ag).
- (2) b-c. Diameter of eye. (contained 2.8 to 5.3 in length of head. ad).
- (3) a-g. Length of body. (standard length).
- (4) a-h. Total length of fish.
- (5) e. Anus.
- (6) a-b. Length of snout.
- (7) f-g. Caudal peduncle (the least height of caudal peduncle is contained from 1.4 to 1.8 times in its own length).
- (8) L. 1. Lateral Line. (25 to 28 scales. 26 in Plate).
- (9) L. tr. Lateral traverse. $4\frac{1}{2}/2\frac{1}{2}$. This represents the number of transverse rows of scales between the middle line of the back and the ventral fin. Here there are $4\frac{1}{2}$ rows above (up to the base of the dorsal fin) and $2\frac{1}{2}$ rows below, (up to the base of the ventral or pelvic fin, counting in each case to the lateral line).
- (10) Barbels. m. b. maxillary (from the upper jaw).
r. b. rostral (from the snout).
- (11) Paired Fins. P. Pectoral.
V. Ventrals or Pelvics.
Vertical Fins. D. Dorsal.
C. Caudal or tail fin.
A. Anal.
- (12) Fin Rays. (s) Simple or spine.
(r) Soft or branched.
- (13) The depth of the body is the vertical distance between the dorsal and ventral surfaces at the deepest part.
- (14) The girth is the measure round the stoutest part.
- (15) Fin formula of Figure 1 D. 4/9. A. 8. P. 17-18. V. 10. C. 19.

Figure 2. Oral features of Mahseers.

(a) Side view of head and fore part of body of a true Mahseer of the *Tor* type, *Barbus (Tor) tor* (Hamilton), showing hypertrophied lips extended. For purposes of drawing, the lips were drawn out to their fullest extent. *In nature the enlarged lips, however, remain compressed and neatly folded, and conforming with the general contour of the head.*

(b) Ventral view of head and fore part of body of B. (Tor) tor (Hamilton) showing the continuous post-labial groove and the enlarging lips with the median lobe of the lower lip.

(c) Ventral view of head and fore part of body of a *Lissochilus*-type of Mahseer, *Barbus (Lissochilus) hexagonolepis* (McClelland). Note the interrupted post-labial groove and the normal lips.

p.l.g.=Post-labial groove.

EXPLANATION OF PRINCIPAL TERMS, ABBREVIATIONS, AND SIGNS USED IN THE DESCRIPTION OF FISH.

D=Dorsal (fin) 'fin' omitted when the meaning is clear.

P=Pectorals.

'Paired' fins.

V=Pelvis (or Ventrals).

A=Anal.

C=Caudal or tail fin.

The Adipose dorsal or Adipose fin has no rays. It is present in many of the Cat-fishes (also in trout and Salmon). Represented by (o) *Formulae for fins*. Figures refer to the number of rays. Two figures separated by a hyphen (-) denote the limits between which the number may vary.

An oblique stroke (/) separates two types of rays in one fin, such as un-divided or entire from divided or branched rays.

A vertical stroke (|) separates different fins, such as the Dorsal from the Adipose dorsal on Cat-fishes, or the Spiny from the Articulated dorsal in Perches.

The Lateral Line (L. l) is a row of perforated scales running from the angle of the gill-opening to the base of the Caudal in most scaled fishes. It may be absent, incomplete or interrupted.

Scales. These are ordinarily counted along the lateral line, where there is one, the number being shown by a figure following the letters L.l. Where there is no lateral line they are counted along the lateral row of the scales where the lateral line would ordinarily be and shown after the letters L. r.

Lateral traverse (L.tr). Another count that is sometimes made is the number of transverse rows of scales between back and belly. It is counted from the base of the Dorsal to the lateral line and again from the lateral line to the point of insertion of the Pelvics. The number is shown after the letters L. tr.

Barbels. These are named after the part from which they spring :—

Nasal from the region of the nostrils.

Rostral from the snout.

Moxillary from the upper jaw.

Mandibular from the lower jaw.

(To be continued)

NOTES ON THE LIVERWORTS OF MURREE HILL.

BY

ABDUL HAMEED, M.SC.,

Lecturer in Biology, Lawrence College, Ghora Gali, Punjab.

(With eight plates).

The following notes are not intended to be exhaustive. Further information on the species described herein can be obtained from 'Liverworts of the Western Himalayas and the Punjab Plain', Parts I and II, published by the Punjab University at Lahore. This important Monograph contains reference to only two species of Liverworts from Murree, namely, *Pellia calycina* and *Frullania gracillima*. The area appears to be rich in Liverworts and as many as 24 species have been collected by the Author.

The author is greatly indebted to Mrs. Pushong for her kindness in sketching the specimens, and to Mr. Ram Saran Chopra, of the Botany Department, Government College, Lahore, for his generous help in identification.

The plants have been collected from a small area only. This area forms a small part of the uncultivated mountainous wedge of the Outer Himalayas. Murree, the most important military hill station, and summer resort of Northern India, is situated on the top of this wedge. The three important European schools of the Punjab, namely, The Lawrence College, The Convent of Jesus and Mary, and St. Denys' School are also situated on this wedge. It varies in height from 5,459 ft. (Murree Brewery), to 7,413 ft. (Kashmir Point) above sea-level. The area is two-faced as regards the distribution of vegetation. The eastern face is dry, with scanty undergrowth, but the western face is shady, dampish, with dense undergrowth.

The trees in this area show an altitudinal zonation in their distribution. From Murree Brewery (5,459 ft.) to Pindi Point (7,242 ft.) the commonest trees are 'Chil' pine (*Pinus longifolia*) and the blue pine (*Pinus excelsa*). In the Murree area (7,237 ft. to 7,134 ft.) one meets with typically English trees such as Horse Chestnuts, Willows, Maples, Poplars and Elms, etc. Further on to Kashmir Point (7,413 ft.) the tall Spruces (*Picea morinda*) form a distinguishing landmark. The Liverworts also exhibit a similar altitudinal zonation in their distribution in this area. For example, though some of the species such as, *Anthoceros himalayensis*, *Marchantia nepalensis*, *Reboulia hemispherica*, *Plagiochasma articulatum*, *P. appendiculatum*, *Pellia calycina*, *Frullania muscicola*, *F. gracillima*, and *Chiloscyphus himalayensis* are generally met with all over this area, the other species are, as a rule confined to special altitudinal zones. The following species are commonly found between the Murree Brewery and the Pindi Point, namely, *Stephen-*

soniella brevipedunculata, *Fimbriaria angusta*, *F. mussuriensis*, *F. reticulata*, *Athalamia pinguis*, *Fossombronia himalayensis*, and *Madotheca decurrens*. The following species as a rule occur between Pindi Point and the Kashmir Point, namely, *Conocephalum conicum*, *Cyathodium tuberosum*, *Targionia hypophylla*, *Fimbriaria Blumeana*, *Athalamia pusilla*, *Radula complanata*, *Lophocolea minor* and *Plagiochila mundaliensis*.

The Liverworts are not generally known to a layman. They are related to the Mosses, and together constitute a very important division of the Plant Kingdom called the Bryophyta. They are small, moisture-loving plants. They grow in shady places along the banks of streams and moist slopes in the hills. Some species grow on rocks, or on the bark of trees. They occur in two forms: the Thallous Form, and the Leafy Form. In the thallous forms the plant body consists of a simple, flat, undifferentiated, green structure called a thallus (Plate 1). The undersurface of the thallus bears scales, and simple root-like structures called rhizoids. The reproductive organs are the archegonia, or female sexual organs, and the antheridia, or male sexual organs. These may develop on stalked receptacles, or on the thallus itself. In some species the male and the female sexual organs are developed on the same plant (monoecious), while in other species they are developed on different plants (dioecious).

In the leafy forms (Plate VI) the vegetative portion of the plant is differentiated into the stem and the leaves. The leaves are developed laterally, and in two rows generally. The upper leaves—the antical leaves or lobes, are as a rule, bigger, and the lower leaves—the postical leaves or lobules, are smaller. In some species a third row of leaves is also developed on the undersurface of the stem. These are called the amphigastria. The sexual organs are not developed on stalked receptacles. The archegonia, when developed, are terminal, and the antheridia lateral in position.

The egg after fertilisation develops into a structure called the sporogonium, which generally consists of a foot, a stalk and a spherical capsule. The capsule contains within it a large number of small bodies called the spores. It also contains thread-like sterile bodies called the elaters. The spores when they fall to the ground germinate into a new plant. Apart from this sexual mode of reproduction, some species bear special structures called the gemmae, which develop either within small cup-like outgrowths on the thallus, or grow freely along the edges of the leaves. These structures can also grow into new plants. Some species produce tubers at the end of the rainy season. These tubers remain buried underground during winter, and when spring comes germinate into new plants.

KEY TO THE SPECIES

1. Dioecious. Thallus with Nostoc colonies embedded in it. The thin pod-like capsule growing out of the involucre ... *Anthoceros himalayensis*
2. Dioecious. Plants large. Gemma cups lobed and toothed ... *Marchantia nepalensis*

3. Dioecious. Plants large. Dorsal surface bears distinct pores ... *Conocephalum conicum*.
4. Dioecious. Plants small. Female receptacle on short, thick stalk. Apical tubers present ... *Stephensoniella brevipedunculata*.
5. Dioecious. Plants small and delicate. Tuber surrounded by hair-like structures ... *Cyathodium tuberosum*.
6. Monoecious or dioecious. Plants generally simple. Under surface dark purple ... *Targionia hypophylla*.
7. Monoecious. Plants simple. Female receptacle, terminal on the main shoot, bears small projections on its upper surface ... *Fimbriaria Blumeana*.
8. Monoecious. Male receptacle on small ventro-lateral shoots. Female receptacle on ventral shoot ... *Fimbriaria mussuriensis*.
9. Monoecious. Female receptacle terminal on main shoot. Male receptacle on lateral shoot ... *Fimbriaria reticulata*.
10. Dioecious. Antheridia lie scattered about. Tubers present... *Fimbriaria angusta*.
11. Monoecious or dioecious. Male receptacle sessile, disc-like, and apical. Female receptacle terminal and lobed ... *Reboulia hemispherica*.
12. Monoecious. Plants large. Male receptacle sessile, V shaped or horse-shoe shaped ... *Plagiochasma appendiculatum*.
13. Monoecious. Plants distinctly articulated. Male receptacle sessile ... *Plagiochasma articulatum*.
14. Monoecious. Plants small and delicate. Antheridia few and sunken on the upper surface ... *Athalamia pusilla*.
15. Monoecious. Plants thick with edges lifted up from ground. Antheridia many and sunken. Scales whitish. *Athalamia pinguis*.
16. Dioecious. Antheridia sunken along the mid-dorsal line. Archegonia protected by involucre ... *Pellia calycina*.
17. Lobes large and rounded. Lobules small. Amphigastria bigger than the lobules ... *Frullania muscicola*.
18. Lobes small. Lobules helmet shaped. Amphigastria not bigger than the lobules ... *Frullania gracillima*.
19. Lobes broadly ovate. Lobules lie flat along the stem. Amphigastria bigger than the lobules ... *Madotheca decurrens*.
20. Lobes entire, overlapping and bear multicellular gemmae. Lobules small and bear rhizoids. Amphigastria absent ... *Radula complanata*.

21. Lobes large. Antheridia near the base of the lobes. Archegonia borne on the lateral shoot ... *Chiloscyphus himalayensis*.
22. Plants small. Leaves slightly bilobed, and bear clusters of unicellular gemmae. Amphigastria bear rhizoids ... *Lophocolea minor*.
23. Plants generally semi-erect and sterile. Amphigastria absent ... *Plagiochila mundaliensis*.
24. Plants small and delicate. Leaf margin wavy. Antheridia orange-yellow in colour. Apical tubers present ... *Fossombronina himalayensis*.

1. *Anthoceros himalayensis* Kashyap.

(Plate I. Figures 1 and 2).

It is a very common plant, and grows in small patches on the moist, shady slopes. The green thallus lies flat on the ground, and bears colourless rhizoids and no scales. It varies in shape considerably, and has invariably bluish-green colonies of *Nostoc* associated with it.

The plant is dioecious. The antheridia are not developed on stalked receptacles, but arise in small cavities below the surface of the thallus. When these cavities burst, the antheridia can be easily seen. The archegonia when young are sunk in the upper surface of the thallus. After fertilisation they are gradually covered over by a wall-like structure developed from the neighbouring tissue. The sporogonium when developed passes through it. In fully grown plants it can be seen as a tube at the base of the capsule. The sporogonium has no stalk, and the capsule is long and pod-like. It is green at first, but later on begins to ripen from above downwards.

2. *Marchantia nepalensis* L. et L.

(Plate I. Figures 3, 4, 5).

It commonly grows on moist rocks in streams, or on shady moist slopes. The thallus is comparatively big and dichotomously divided. Its under surface bears colourless rhizoids and a few brownish scales.

The plant is dioecious. The archegonia are developed on the under surface of the slightly lobed, stalked receptacles. They are developed first about the middle of April. The receptacles bearing antheridia are bigger and have short stalks. Later on in the year the plants develop gemma cups and increase in size.

3. *Conocephalum conicum* (L.) Necker.

(Plate II. Figures 1 and 2).

It is the largest Liverwort found in this area. It is quite common, and is found growing on moist rocks or shady slopes round about Kashmir Point. The plants grow in large, dense, and light-green patches of overlapping individuals. The thallus is dichotomously divided, and bears long rhizoids and violet coloured scales on the under surface. The upper surface bears minute pores which can be seen with the naked eye. The margin of the thallus is undulating.

The plant is dioecious. The antheridia which grow on thick, disc-like receptacles are surrounded by cup-shaped depressions. The stalk of the receptacle is very small, and its upper surface bears small projections. The archegonia appear later in cup-shaped depressions, which are surrounded by small scales.

4. *Stephensiella brevipedunculata* Kashyap.

(Plate II. Figures 3 and 4).

It is a rare plant, and is found growing on sunny rocks below Pindi Point. The thallus is generally simple, though sometimes divided. The ventral surface

is greenish, and bears rhizoids and a few colourless scales. Adventitious shoots are developed in some cases from the ventral surface of the thallus. They separate and form new plants.

The plant is dioecious. The antheridia grow in clusters on the upper surface of the thallus. The archegonia are developed on thick, short-stalked receptacles. The plants generally produce tubers at the end of the rainy season.

5. *Cythodium tuberosum* Kashyap.

(Plate II. Figures 5, 6, 7).

It is a rare plant. It grows on rocks in shady and dark corners, along the forest road below St. Denys' School. The plants grow in small, isolated yellowish-green patches. The thallus is thin, delicate, and variable in shape. Tubers are commonly developed, and each tuber is surrounded by forwardly directed hair-like structures.

The plant is dioecious. The receptacles bearing antheridia vary in shape. The stalk when present is very short. The archegonia lie scattered about on the thallus, and are well protected by structures called the involucre.

6. *Targionia hypophylla* L.

(Plate II. Figures 8 and 9).

This plant is very common round about Kashmir Point, especially along the shady, moist slopes. It grows in patches of overlapping individuals. Each plant is attached to the ground by its base. The thallus is generally simple, rarely divided. The under surface is dark purple, and is provided with scales. The apex bears a thick, scale-covered shoot. Plants growing in shady corners are bluish in colour.

The plants are monoecious, or dioecious. The antheridia vary in their position on the thallus.

7. *Fimbriaria Blumeana* Nees.

(Plate III. Figure I.)

This plant grows among weeds along shady, moist slopes round Kashmir Point. The thallus is generally simple, rarely divided, and is of a yellowish green colour. The ventral surface bears a few purple scales and rhizoids.

The plant is monoecious. The antheridia are situated behind the stalk of the female receptacle, and they grow together to form a cushion-like structure. The archegonia are developed on a long-stalked, lobed receptacle, whose upper surface bears small projections.

8. *Fimbriaria mussuriensis* Kashyap.

(Plate III. Figure 2.)

The plant grows on moist, shady slopes along the west road near the stream. The thallus is generally simple, and of a yellowish-green colour. The plants grow in isolated patches of overlapping individuals. The ventral surface bears a few rhizoids, and some reddish and colourless scales.

The plant is monoecious. The antheridia are developed on ventro-lateral shoots, and grow together into a cushion-like structure. The archegonia are developed on stalked receptacles, which grow on side shoots.

9. *Fimbriaria reticulata* Kashyap.

(Plate III. Figure 3.)

This plant is very rare. Only a few specimens have been collected from the shady, moist slopes along the west road near the stream. The thallus is generally simple, rarely divided, and yellowish-green in colour. The plants do not grow in large patches. Purple scales are present.

The plant is monoecious. The antheridia grow on lateral shoots, and form a cushion-like structure. The archegonia are developed on stalked receptacles, which grow terminally on the main thallus. The upper surface of each receptacle bears small projections.

10. *Fimbriaria angusta* St.

(Plate III. Figures 4 and 5.)

It is a rare plant, and is found growing on sunny rocks along the east road below Pindi Point. The plants generally grow in patches among weeds. The thallus is generally simple, rarely divided, and has a wavy margin.

The plant is dioecious. The antheridia are found scattered about on the upper surface, and form a long cushion-like structure. The male plants turn white when dry. The archegonia are developed on disc-like, stalked receptacles. Some plants produce tubers at the end of the rainy season.

11. *Reboulia hemispherica* (L.) Raddi.

(Plate IV. Figures 1 and 2.)

It is a very common plant, and is found along the shady, moist slopes throughout this area. The plants are generally of bluish-green colour. The ventral surface is purple in colour. They grow in dense patches of overlapping individuals, and show a great variety of form.

The plants may be monoecious or dioecious. The receptacles bearing antheridia are disc-like, sessile and apical in position. They are generally surrounded by scales. The archegonia are developed on stalked, terminal, lobed receptacles.

12. *Plagiochasma appendiculatum* L. et. L.

(Plate IV. Figures 3 and 4.)

It is a very common plant, and forms large patches on rocks throughout this area. The thallus is fairly large, broad, and dichotomously divided as a rule, though the species shows considerable variation in form. The ventral surface is purple.

The plant is generally monoecious. The receptacles bearing antheridia are sessile, and may be V-shaped or horse-shoe shaped. They lie scattered about on the thallus, and are surrounded by scales. The female receptacles are lobed, and sessile at first, and lie scattered about.

13. *Plagiochasma articulatum* Kashyap.

(Plate IV. Figures 5 and 6.)

It is a very common plant and is found all over this area, especially on exposed sunny rocks. The plants grow in dense patches of small, green individuals. The ventral surface is purple in colour. The thallus is distinctly articulated.

The plant is generally monoecious. The male receptacles are terminal, V-shaped, and surrounded by scales. Apical adventitious shoots generally grow out from under them. The female receptacles are generally 3-lobed. They are sessile at first, but a stalk is developed later on.

14. *Athalamia pusilla* Kashyap.

(Plate V. Figures 1 and 2.)

It is a rare plant. It grows in small patches on shady ground, or between stones round Kashmir Point. The thallus is small, delicate, and dichotomously divided. The ventral surface is greenish, and bears a few purple scales.

The plants are generally monoecious, though dioecious specimens are also met with. The antheridia are few, sometimes only one in the middle of the thallus. The female receptacles are small, stalked and 2 or 3 lobed.

15. *Athalamia pinguis* Falc.

(Plate V. Figures 3 and 4.)

It is a common plant. It grows below rocks on sunny slopes below Pindi Point. The thallus is thick, generally simple, rarely divided. The edges of the thallus are lifted up from the ground to give it a concave appearance. The ventral surface is covered with whitish scales. The plants turn white when dry.

The plant is monoecious. The antheridia are many, and look like small whitish projections near the base of the stalk. The female receptacles are sessile at first, but bear thick stalks later on. As many as 3 may be developed on the same thallus, but all do not mature. Each receptacle is surrounded by scales.

16. *Pellia calycina* (Tayl.) Nees.

(Plate V. Figures 5, 6 and 7).

It is a very common plant. It grows among weeds in large green patches all over this area, especially along shady slopes or under stones in running water. The thallus is dichotomously divided. At the end of the rainy season the plants grow in size and assume parsley-like appearance. The plant is dioecious. The antheridia lie scattered about along the mid-dorsal line. The archegonia grow in clusters, and are protected by a tubular involucre. The sporogonium has a very long and delicate stalk. The capsule is small, and dark brown in colour and splits in March.

17. *Frullania muscicola* St.

(Plate VI. Figure 1).

This plant commonly grows in closely applied, brownish patches on the bark of oaks and pine trees. Plants may be found growing on rocks. The stem is generally short and slender; may be simple or branched. It bears 3 rows of leaves. The upper leaves (lobes) are bigger, rounded, and grow out horizontally. The lower leaves (lobules) are small, with their margins rolled back. The amphigastria are bigger than the lobules. Each has a notched apex, bears dark brown rhizoids, and lies under the stem.

18. *Frullania gracillima* St.

(Plate VI. Figure 2).

It commonly grows on the bark of trees, and is generally associated with *F. muscicola*. The upper leaves are smaller and rounded. The lobules are helmet-shaped. The amphigastria are not bigger than the lobules. They bear rhizoids, and lie along the stem. The apex is notched.

19. *Madotheca decurrens* St.

(Plate VI. Figure 3).

The plants generally grow in patches on the bark of trees, and on rocks. The patches are not closely applied. The stem is branched. The upper leaves are broadly ovate, and their bases overlap. The lobules are flat and run along the stem. The amphigastria are bigger than the lobules.

20. *Radula complanata* (L.) Dum.

(Plate VII. Figure 1).

The plants grow in yellowish green or whitish green patches on the bark of trees or on rocks round Kashmir Point. The stem is closely applied to the substratum, and is branched. The upper leaves are overlapping, and entire. Their margins bear multicellular gemmae. The small lobules are closely applied to the lobes and bear rhizoids. The amphigastria are absent. The female reproductive organs are developed at the apex of the branch.

21. *Chiloscyphus himalayensis* St.

(Plate VII. Figure 2).

The plant grows in pale green patches among weeds along shady moist slopes all over this area. The stem is branched, and bears large, imbricate leaves. The rhizoids grow from small amphigastria.

The plants are monoecious or dioecious. The male organs are developed on the stem near the base of the leaves. The sporogonium has a long hyaline stalk, and a dark brown capsule. The base of the stalk is surrounded by a bell-shaped structure called the parienth.

22. *Lophocolea minor* Nees.

(Plate VII. Figure 3).

It is a rare plant, and grows in small, dense, yellowish-green patches on the bark of trees or on the ground. The plants are very small, bear alternate, slightly bilobed leaves. The free margins of the leaves always bear clusters of unicellular gemmae. The rhizoids are long and grow in tufts from the amphigastria.

23. *Plagiochila mundaliensis* St.

(Plate VIII. Figure 1).

It is not a common plant. It grows among weeds in shady moist spots at the foot of the trees below Kashmir Point. The plants are semi-erect, and branched. The branches bear large, alternate leaves with their upper margins irregularly dentate. The underground stem is creeping, and bears rhizoids and a few brownish leaves. The amphigastria are absent. The plant is generally sterile.

24. *Fossombronina himalayensis* Kashyap.

(Plate VIII. Figures 2 and 3).

The plants grow in green isolated small patches on rocks, especially during the latter part of the rainy season. The slender stem bears delicate, oblong, and overlapping leaves with beautifully wavy margins. The plants are monoecious or dioecious. The antheridia are orange yellow, and are found scattered about near the bases of the leaves. The sporogonium has a thin erect stalk, and a small brownish capsule. Tubers are developed at the end of the rainy season.

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EXPLANATION OF PLATES.

Plate I.

Anthoceros himalayensis.

1. A female plant showing involucre (v) and capsule (c) of the sporogonium.
2. A male plant showing antheridia (a).

Marchantia nepalensis.

3. A plant showing a stalked male receptacle (m).
4. A female plant showing 4 stalked female receptacles (f).
5. A plant thallus. (t) showing gemma cups (g) and rhizoids (r).

Plate II.

Conocephalum conicum.

1. A plant showing male receptacles (m).
2. A plant showing female receptacles (f). Note the small pores on the upper surface of the thallus.

Stephensiella brevipedunculata.

3. A plant showing antheridia (a) and tubers (t).
4. A plant showing stalked female receptacle (f).

Cyathodium tuberosum.

5. A plant showing archegonia surrounded by involucre (v).
6. A plant showing male receptacle (m).
7. A plant showing tubers (t) surrounded by hair-like structures (m).

Targionia hypophylla.

8. A female plant bearing rhizoids (r).
9. A male plant showing a ventral shoot bearing a male cushion.

Plate III.

Fimbriaria Blumeana.

1. A single plant showing stalked female receptacles (f) and antheridia (a).

Fimbriaria mussuriensis.

2. A single plant showing stalked female receptacles (f) and antheridia (a) on lateral shoots.

Fimbriaria reticulata.

3. A single plant showing terminal stalked female receptacles (f) and antheridia on lateral shoots (a).

Fimbriaria angusta.

4. A male plant bearing antheridia (a) and tubers (t).
5. A female plant showing stalked receptacle (f).

Plate IV.

Reboulia hemispherica.

1. A plant showing male receptacles (m) and stalked female receptacles (f).
2. A plant showing only male receptacles (m).

Plagiochasma appendiculatum.

3. A plant showing male (m) and female (f) receptacle.
4. A plant showing only female receptacles (f).

Plagiochasma articulatum.

5. A plant showing male receptacles (m).
6. A plant showing a single stalked female receptacle (f).

Plate V.

Athalamia pusilla.

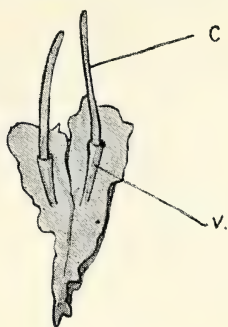
1. A plant showing antheridia (a) and stalked female receptacle (f).
2. A plant showing only antheridia (a).

Athalamia pinguis.

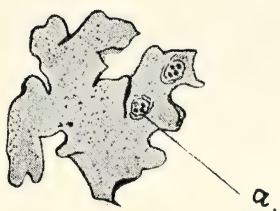
3. A plant showing a single female receptacle (f) and antheridia (a).
4. A plant showing antheridia (a) and a single stalked female receptacle (f).

Pellia calycina.

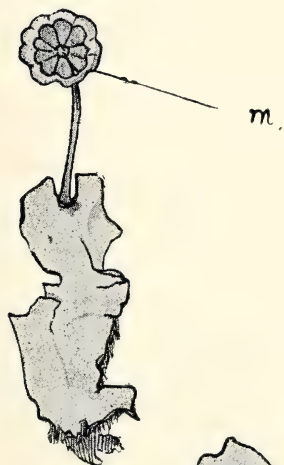
5. A plant showing involucre (v) and stalk (k) and capsule (c) of the sporogonium.
6. A plant showing involucre (v) only.
7. A plant showing antheridia (a).



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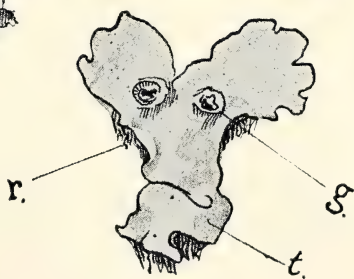
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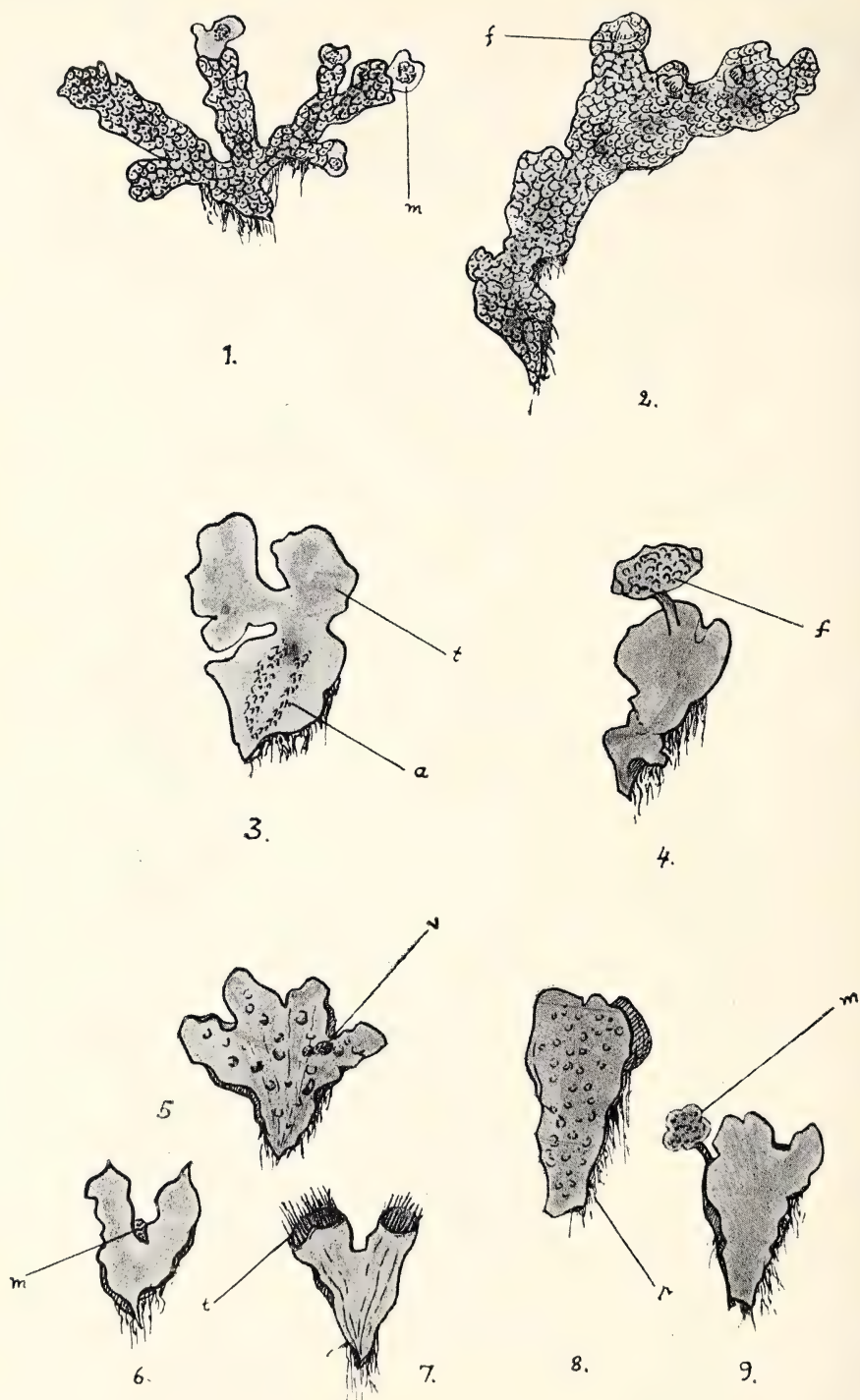
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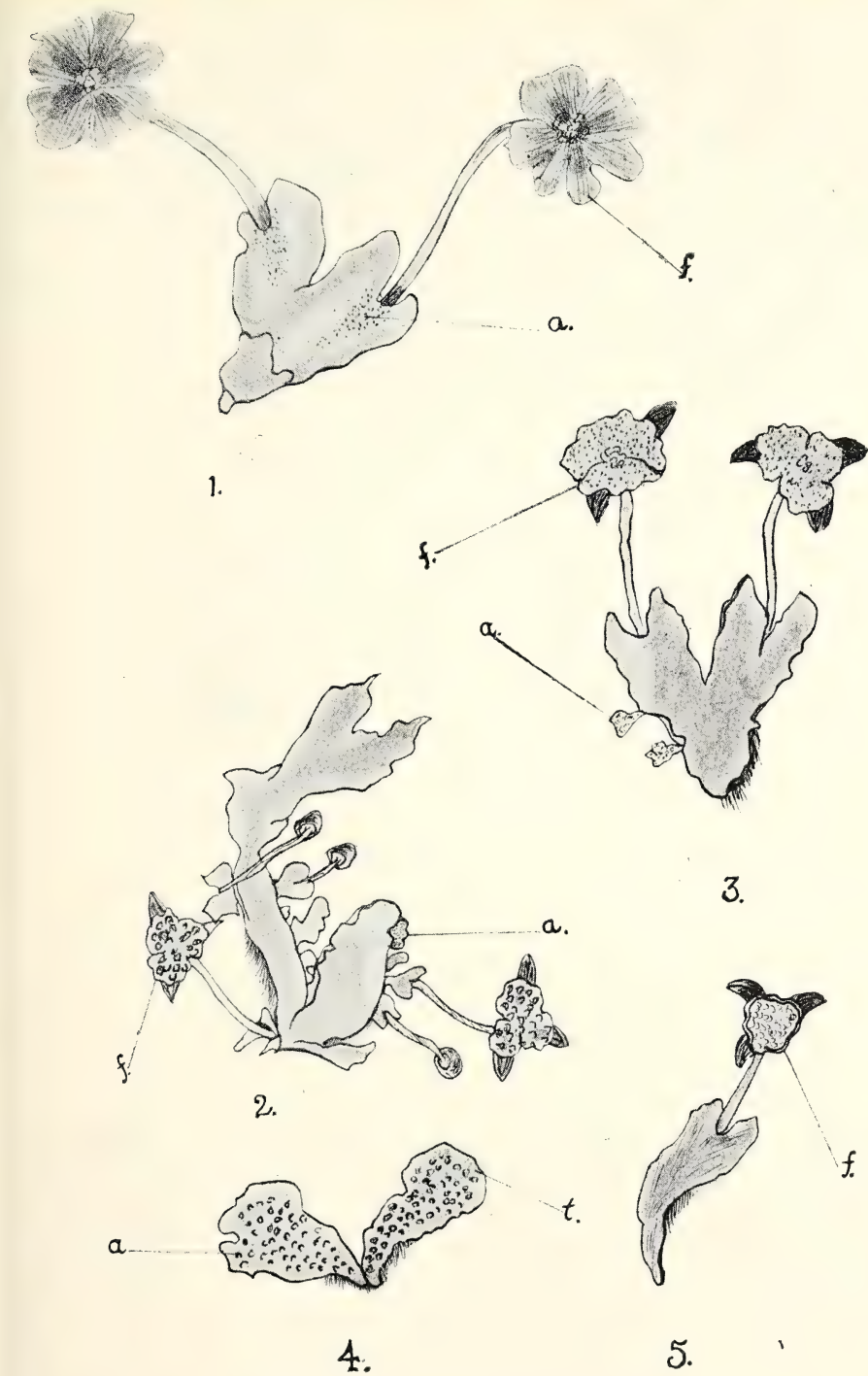
Abdul Hameed.—Liverworts of Murree Hill.

For explanation see end of article.

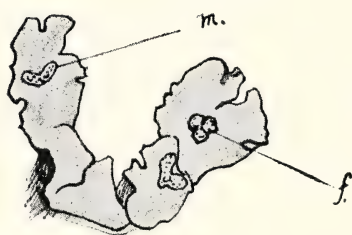
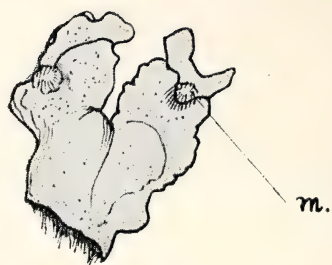
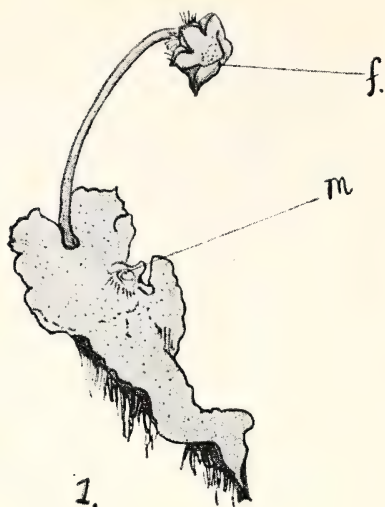


Abdul Hameed.—Liverworts of Murree Hill.

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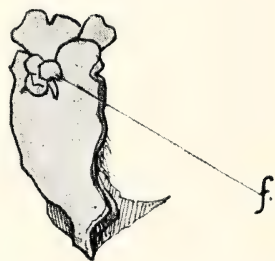


Abdul Hameed,—Liverworts of Murree Hill.
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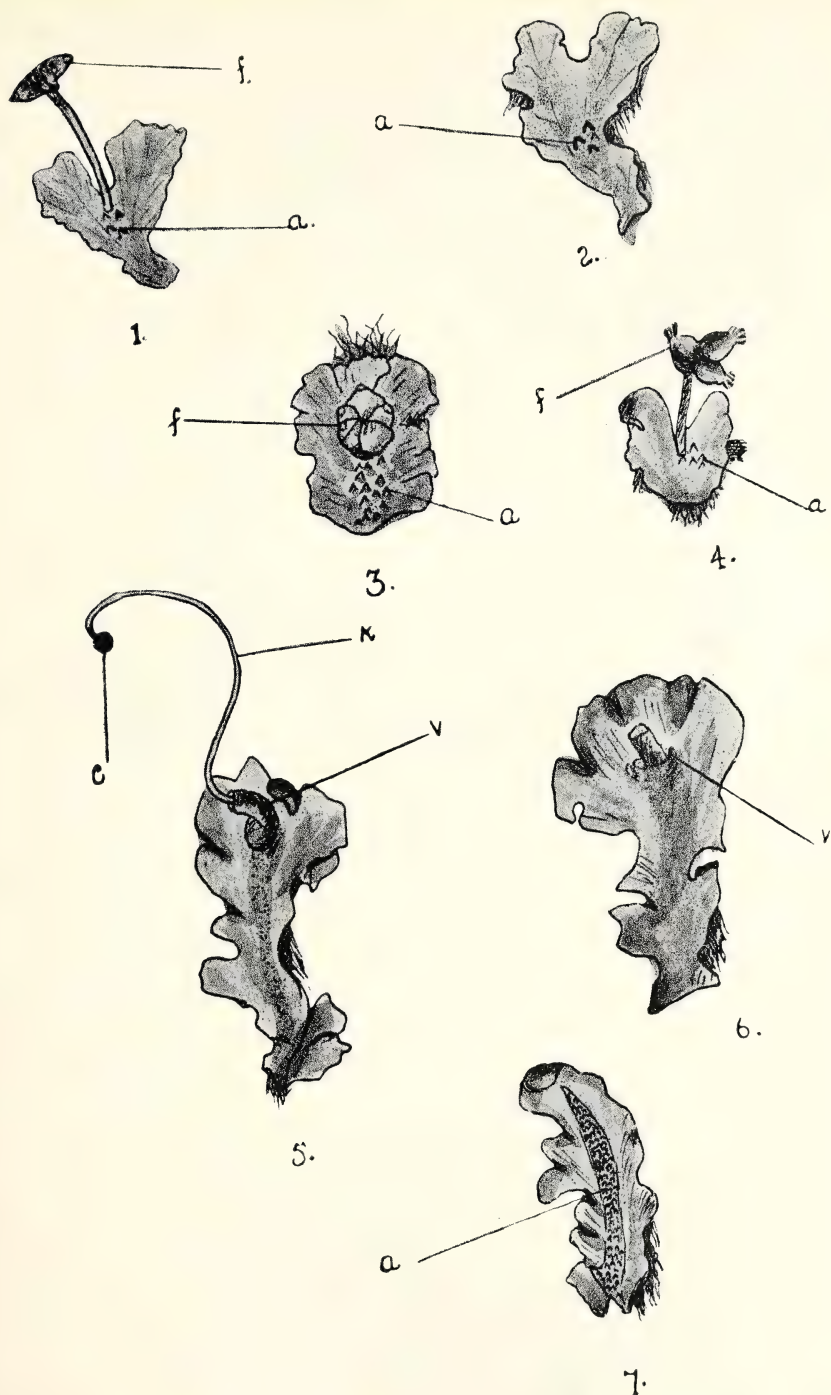


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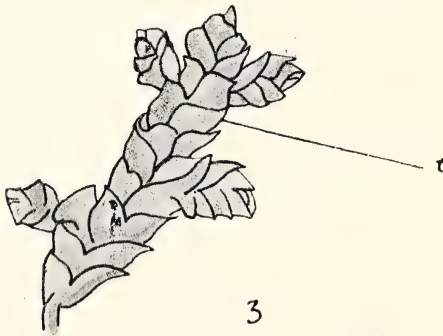
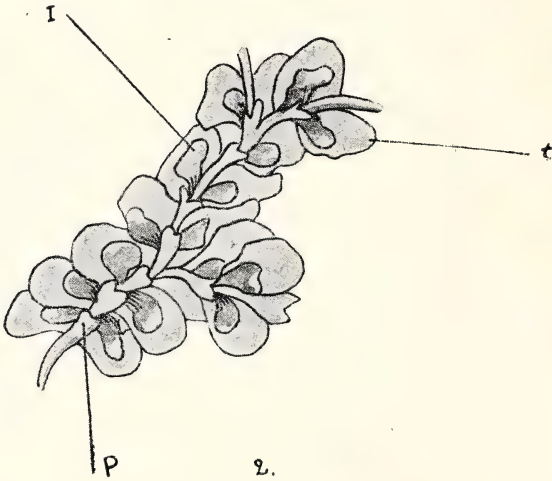
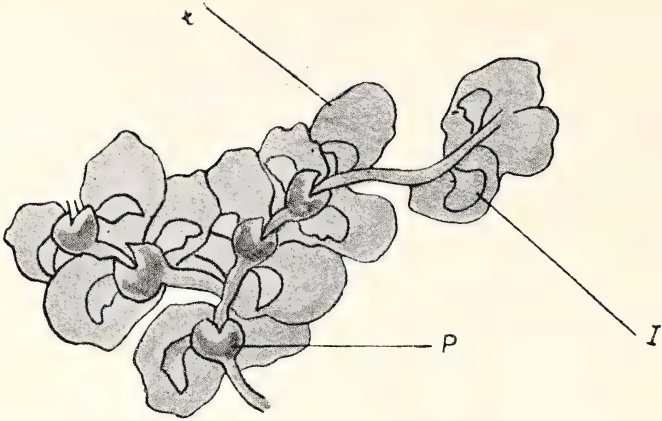
Abdul Hameed.—Liverworts of Murree Hill.

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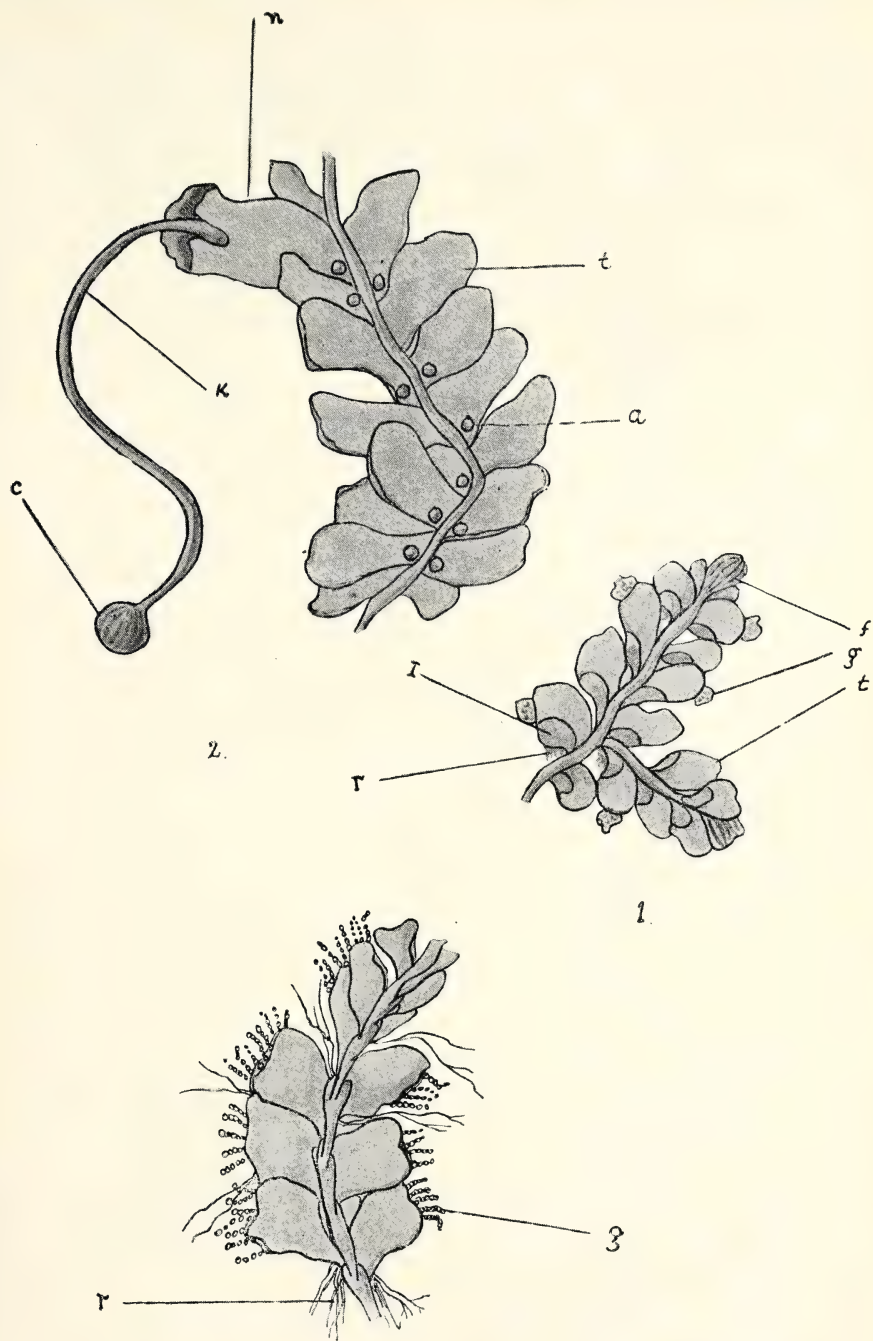


Abdul Hameed.—Liverworts of Murree Hill.

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Abdul Hameed.—Liverworts of Murree Hill.
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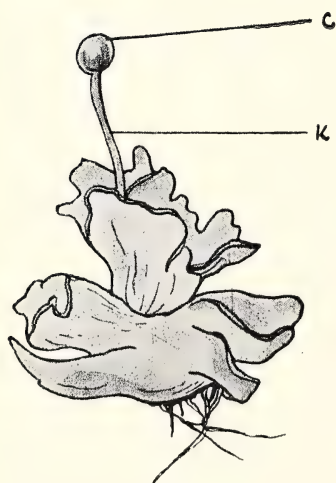
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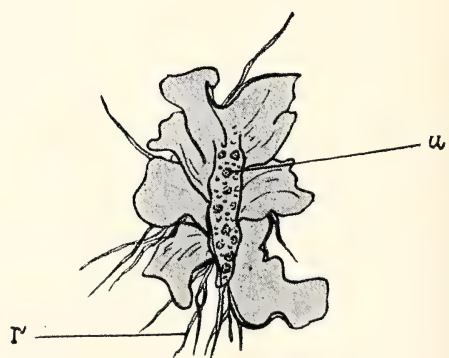
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Abdul Hameed.—Liverworts of Murree Hill.

For explanation see end of article.

Plate VI.

Frullania muscicola.

1. Ventral view of a branch showing amphigastria (p), lobules (l) and the upper leaves (t).

Frullania gracillima.

2. Ventral view of a branch showing amphigastria (p), lobules (l) and the upper leaves (t).

Madotheca decurrens.

3. Dorsal view of a branch showing the arrangement of the upper leaves (t).

Plate VII.

Radula complanata.

1. Ventral view of a branch showing lobules (l) with rhizoids (r) upper leaves (t) bearing gemmae (g) and a female reproductive structure (f).

Chiloscyphus himalayensis.

2. Dorsal view of a branch showing the upper leaves (t), antheridia (a), stalk (k), and capsule (c) of sporogonium, and perianth (n).

Lophocolea minor.

3. A single plant (dorsal view) showing rhizoids (r) and the upper leaves bearing gemmae (g).

Plate VIII.

Plagiochila mundaliensis.

1. A plant showing the insertion of the leaves and the creeping underground stem bearing rhizoids (r).

Fossombronia himalayensis.

2. A plant showing a stalk (k) and the capsule (c) of the sporogonium.
3. A plant showing antheridia (a) and rhizoids (r).

SOME OBSERVATIONS ON THE NESTING HABITS OF
THE INDIAN COURSER, *CURSORIUS COROMANDELICUS*
[GMELIN]

BY

W. W. A. PHILLIPS, F.L.S., M.B.O.U.

(With 3 plates).

Courserers have always held a great attraction for me. They are so typical of the wide, open plains and deserts of the East, so energetic, so full of life and movement—yet so elusive.

It was in Mesopotamia, during the last Great War, that I first made their acquaintance. Well I remember watching them, with great interest, while they ran swiftly hither and thither over the maidan, outside the town and between the trenches, during the siege of Kut-al-Amara, early in 1916. These were, of course, the Cream-coloured Courserers (*Cursorius cursor cursor*) but, with the exception that they were slightly larger and lighter-coloured birds and lived in more definitely semi-desert areas, they were very much like our Indian Courser.

After the war, I encountered this courser again, in small numbers, when I was shooting sandgrouse on the fringe of the Sind desert. But it was not until some years after my return to Ceylon that I met the smaller and darker bird, which is the subject of these observations.

Along the north-west coast of Ceylon, from the north of Puttalam to the Jaffna Peninsula, are extensive tracts of slightly undulating, bare pastures and salty wastes, stretching from the sea, inland, a mile, two miles or in some places as much as ten miles, until they are engulfed by the jungle or melt into cultivated areas. During the rains of the north-east monsoon, these plains are covered with a short, wiry green grass and a few scattered low shrubs but, for the greater part of the year, they are parched and hard-baked and lie shimmering in the heat of the sweltering sun. Large herds of cattle roam at will, grazing on the sparse herbage while the struggling bushes of thorny acacias (*A. planifrons* and *A. eburneus*) are kept in check by the browsing of flocks of voracious goats.

Although, in most areas, these plains are so vast that they fade away on the horizon, in some places they are broken by clumps and spinneys of flat-topped acacias, tall palmyras and other dry-zone trees and bushes while straggling fences show where attempts have been made to cultivate patches of paddy during the wet weather. In some places, the land slopes slightly to hollows which are shallow pools and water courses during the rains while in other parts there are dry, sandy hillocks. These plains are the home of the Indian Courser in Ceylon. They are ideal for its requirements and consequently the species is found



Photo by

The Indian Courser (*Cursorius coromandelicus* [Gmelin])
(Incubating her two eggs)

W. W. A. Phillips

in some numbers distributed throughout the plains in the breeding seasons or collected into small flocks during the rains.

My first contact was made during the Christmas holidays some years ago. We were shooting Golden Plover (*Pluvialis dominicus fulvus*) and Pintail Snipe (*Capella stenura*) in the more marshy areas, in the vicinity of Mannar, when we put up several flocks of Coursers. At this season—that is to say, during the rains of the north-east monsoon when the plains are wet and often marshy—all the coursers appear to be gathered into small flocks of four or five to eight or nine. Probably these flocks are composed of several family groups that have joined up for mutual protection or companionship. Although they spend most of the time on the ground, running rapidly hither and thither in the typical courser manner, they will readily take wing and, rising some hundred or so feet into the air, fly to another part of the plain.

The flight is a rapid flapping of the wings, reminding one greatly of the flight of the European Green Plover or Lapwing. In fact, on the wing, in their small flocks, the Indian Coursers bear a distinct resemblance to small Green Plovers while, when they are on the ground, running rapidly with heads down, they might be mistaken for small members of the partridge family.

Our first effort, to discover the nest of this interesting bird, was made during the second week in May, 1939—but we were disappointed for either we were too early or, more probably, their eggs had already been laid and subsequently destroyed by the heavy rain-storms that occurred, unusually late, that year. The following year we were unable to visit the Mannar district at the appropriate season but, this year (1941), during the week-end of the 30th May/1st June, we made another trip with the special object of finding and photographing the eggs, and possibly also the young, of this Courser—and this time we were not disappointed. During the early hours of the morning, we arrived at our usual Camp-site, protected from the wind and sun by a clump of thorny, flat-topped acacias growing on the fringe of the plain, and, soon after dawn, we were up eagerly scanning the wastes through our field-glasses. Many Yellow-wattled Lapwings (*Lobipluvia malabarica*), a few Little Terns (*Sterna albifrons sinensis*) and a single Red-wattled Lapwing (*Lobivanellus i. indicus*) were brooding their eggs within sight of camp. In the rays of the early morning sun, they showed up very distinctly against the background of close-cropped, sun-scorched grass—but of Coursers there were none to be seen.

After an early and hurried breakfast, the car was brought out and we motored slowly and carefully over the hard-baked plains, keeping a good look out for the little brown sprinters. Bird watching from a small closed car, under these circumstances, has many advantages. One quickly develops the proper technique for avoiding thorn-scrub, boulders and ruts while, at the same time, critically examining the country-side for birds, their nests and their eggs. The advantages of this method are manifold. Much more ground can be covered than on foot; one can

carry one's camera, hide, accessories, food, drink, etc., without effort and without tiring out oneself; one keeps cool, in the blazing sun, and, above all, one remains concealed and can approach, comparatively closely, to shy birds without exciting undue suspicion.

As long as one sits quietly inside, without too much movement, it is extraordinary how little notice birds and animals will take of a slowly moving or stationary car. Many a time, I have motored slowly up to a Red-wattled or a Yellow-wattled Lapwing as it has sat brooding its eggs and it has continued to sit until the car has arrived within a few yards of it; then it has got up, reluctantly left the eggs, and run a few yards to one side with an obviously puzzled look in its eyes. Or I have sat in a stationary car, with field-glasses focused, and watched an unsuspecting bird onto its nest—a bird that, had I been on foot, would have been miles away before I had arrived anywhere in the vicinity of its treasures.

On this morning, we motored slowly over the undulating plain, avoiding hazards and stopping every now and then to spy out the land. Several Coursers were seen but all of them appeared to be engaged in feeding and quite innocent of any hidden secrets. Probably they were males enjoying a bachelor existence, while their mates incubated their eggs in another area—for the male does not appear to do his fair share of the domestic duties. Eventually, however, a pair were observed that showed a little more concern at our approach; they continued to run about instead of taking flight and flying out of sight.

Stopping the car, we watched them for some time gradually working further and further away from our vicinity—head down—a short run—stop—head up—a moment's look round—then head down again and another short run, repeated time and again. Then, after watching for a little while, we realised that they were being followed by a much smaller object, a well grown young one which was imitating their movements and occasionally receiving a morsel of food from one or other of them. A closer approach and the young one squatted, motionless, while the parents took wing and flew towards the horizon. The young chick, which was less than half grown, was of a much lighter hue than its parents and was spotted and barred on its upper plumage resembling far more a miniature Spotted Sandpiper than an adult Indian Courser. Its colouring was admirably protective; it was most difficult to distinguish it as it lay crouched and immovable beside and half sheltered by a dwarf thorny acacia. Suddenly, however, when it realised that it had been discovered by the awesome eye of the camera, it took to its heels, running at great speed for such a small chick, and circling and dodging to avoid capture. Having been caught, with some difficulty, however, it again crouched without movement, while it was photographed and left to its own devices.

While returning from this successful chase, another Courser was observed which also seemed to be acting in rather an unusual



Hatchling of Indian Courser



Photos by

Chick of Indian Courser

W. W. A. Phillips

manner. Watched from a distance, its activities were seen to be centered upon a spot some fifty feet from an open fence that straggled, at this point, across a portion of the plain. Every now and again its short runs, punctuated by the usual stops for observation or to pick up some insect, would converge upon the same spot, where it would stop for a moment, head down, and then resume the runs in another direction. A closer approach and more careful observation fixed the spot in our eyes and, leaving the car, we slowly approached. At first, a careful search revealed nothing unusual but a still closer scrutiny disclosed, in the end, a minute object, crouched beside a piece of desiccated cow-dung—a newly hatched Courser! And what a delightful little hatchling it was! A tiny, mottled ball of down, so like its surroundings that even though one knew the exact spot where it lay, it was most difficult to distinguish it. The down was mottled, irregularly, a rather deep shade of reddish-brown and black, and this colouring blended in such a remarkable way with the debris amongst which the hatchling had concealed itself that it was lost the minute that one took one's eyes from off it. Evidently it had been hatched out for only a few hours. It seemed too weak on its legs to attempt to run and, in size, it was very little larger than the egg from which it had emerged.

Erecting a hide beside the broken fence that, luckily, lay to the eastwards and focusing the camera as nearly as possible on the spot where the chick crouched, the car was sent away and we watched for the mother's return. Sooner than we had dared to hope, she was seen in the offing. She had not been far away and evidently believed that we had all left in the car. She came from a little distance, working gradually closer with the usual, short, aimless-looking runs until she arrived in the close vicinity of the place where she had left her offspring. Then, while she appeared to be looking for it, it rose on its weak little legs and tottered the last few feet to join her—and was fed. But she was a little worried by the closeness of the hide, which had sprung up so suddenly and so surprisingly during her absence, for she began to shepherd her chick, further and further away, enticing it to join her each time she came to feed it. Of the male there was no sign; presumably he was away feeding somewhere else, for he did not put in an appearance during the whole two hours his mate was under observation.

Although it was after eleven o'clock, the chick was fed frequently. Whenever the mother found a suitable insect, she would run back to it, not directly or in one long run but with the short aimless-looking sprints so typical of the Courser family. She made no demonstrations when her chick was caught and handled—nor did the pair in the previous incident. In both cases, they vanished, leaving the chicks quite alone, evidently trusting that the remarkable protective colourings would suffice to keep danger away. In this they were very different from the Plovers which demonstrated, continually, when we were near their eggs or young.

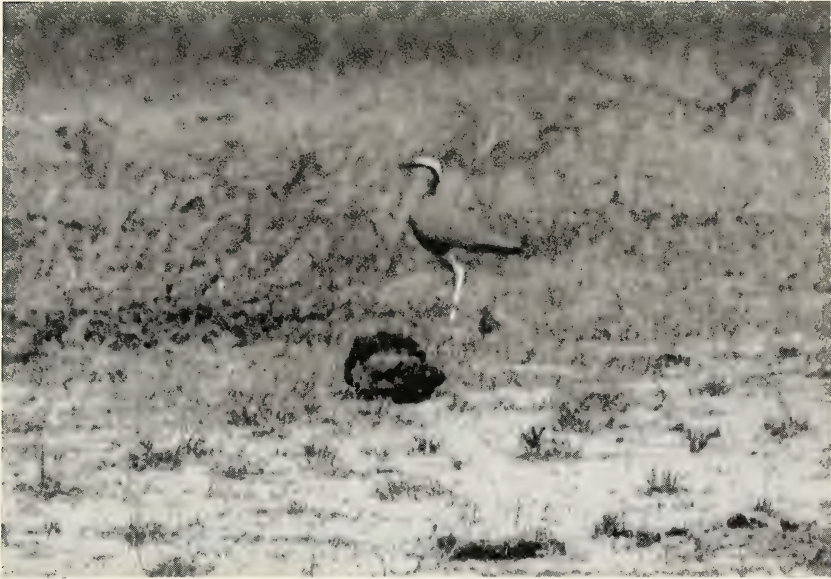
In the comparative cool of the late afternoon, we motored to

another part of the plain, some six miles distant. Here were several pairs of Coursers, apparently feeding. One pair was singled out for close watching and it soon became evident that these birds were either feeding within their own chosen territory, which the cock was prepared to defend against others of his own kind, or that he was jealous of any other Courser approaching his mate. For he was observed, continually, to chase and drive off another pair that were attempting to encroach upon what appeared to be his feeding grounds.

After some fifteen minutes, this pair began to work their way, right-handed, towards some low, scrub-covered sandhills, which they reached in due course after much zigzagging. Now, they changed their direction and started working down the sandhills, parallel to the car. For another fifteen or twenty minutes they continued running backwards and forwards and feeding, one occasionally running off to some distant objective and then hastening back to join its mate. Then, quite suddenly, after nearly three quarters of an hour (by which time we had almost decided to give up and move elsewhere) one, which turned out to be the female—left her mate and was seen making a longer run than usual, straight towards the car. Closer and closer she came until, when about fifty yards distant, she stopped and, after a moment's hesitation, crouched down—and remained crouching! As the car drew near she rose hurriedly and ran off again—disclosing two handsome eggs, lying side by side on the bare ground. Broad, blunt ovals in shape, they were a little over an inch in length and of a pale yellowish buff ground-colour, densely overlaid with irregular blotches, smears, lines and speckles of dark violet-grey and black—a wonderfully protective colouring, most difficult to distinguish from the bits of desiccated cow-dung and other debris lying in close proximity to where they were placed.

From the initial behaviour of the birds, it was now obvious that, when we arrived in their neighbourhood we had, inadvertantly, driven them away from the vicinity of their eggs and that the hen had then taken a considerable time to make up her mind to return to them, for the car was parked close to her normal line of approach. Thus, she had had to make a considerable detour, round three sides of a square, in order to approach them without passing too close to the car. This, she had done gradually, without giving away the fact that she was interested in any particular spot until, at the last moment, she had headed directly for it.

As rapidly as possible, the hide was erected—to the eastwards of the nest in order to obtain the best light from the morning sun—anchored against the force of the monsoon winds that were fiercely sweeping the plain, and disguised as well as circumstances would permit; we then retired to another area and continued, until dusk, our search for more nests and eggs. Although no other Courser's eggs were discovered, four eggs of the Black-winged Stilt (*Himantopus h. himantopus*) in a slight nest on a bank overlooking a lagoon, three eggs of the Indian Kentish Plover (*Leucopoliis alexandrinus seebohmi*) lying half-buried by blown-sand in a slight



Indian Courser approaching nest.



Photos by

Eggs of the Indian Courser

W. W. A. Phillips

scrape and several nests and eggs of the little Ashy-crowned Finch-lark (*Pyrrhulauda grisea*) and the Nilgiri Sky-lark (*Alauda gulgula australis*) were located.

Next morning, as soon as the light was fit for photography, we motored back to the hide—to see the Courser leave her eggs and run rapidly away at our approach. A quick change from car to hide, a careful focusing of the eggs and we were ready for the car to leave and for the bird to return to her duties. Hardly twelve minutes later she came into sight, sprinting in the usual fashion and gradually working nearer and nearer to her objective—and then—she had arrived and was standing over her eggs, looking a perfect picture in the morning sunlight.

She took no notice of the camera lens or the noisy release of the shutter. Evidently she was confident that, as she could see no one on the plain, everything must be quite safe. She sat close, but alert, with her head held moderately high so that she could watch for the approach of danger, for apparently her mate would give her no assistance in this way. Occasionally, she sifted her position and once or twice, turned her eggs but she incubated them alone—there was no sign of her mate.

From the incidents just recorded, it would seem probable that the Indian Courser, in Ceylon, normally lays its eggs during the latter half of May but, if the weather conditions are favourable, one or two pairs may lay as early as the beginning of that month; that the parents do not demonstrate, in any way, when their eggs or young are approached—they fly away and trust to the effectiveness of their obliterative colouring to keep them from harm—and that the female does most, if not all, of the incubation of the eggs and the care of the newly-hatched chick but that the male, sometimes, assists in the feeding and education of the young when they are feathered.

Apart from the risk of annihilation by the feet of grazing cattle, jackals, dogs and crows, all of which quarter the ground seeking for eggs and young of ground-nesting birds, constitute the chief menace to the Courser, in Ceylon. But as the concealment, afforded by the protective colouring of both the eggs and the young, has attained such a high degree of effectiveness, there would seem to be no reason to fear that the species will be unable to maintain itself in considerable numbers on our coastal plains.

A 'BUSMAN'S' HOLIDAY IN THE ABU HILLS.

BY

CHARLES MCCANN, F.L.S.

(One plate and one text-figure)

The Abu Hills are an enormous mass of gneissic rock rising steeply out of the plain, and standing well apart from the rest of the Aravalli Range. The highest peak, Guru Sikar (Shunkar), rises 5650 feet above sea level and is crowned with a shrine to Dhuttashri, into the construction of which a conveniently weathered bolder has been incorporated. From the Oria Dak Bungalow this edifice appears like a gigantic statue of Buddha. Guru Sikar is the highest point between the Himalayas and the Nilgiris. The Abu rocks weather in a most peculiar way, and often assume fantastic shapes. To wit, the famous Toad Rock which when viewed from a certain angle looks like a gigantic toad ready to take plunge into the Naki Lake below. A hill face pitted with hollows is known to the school boys as 'Spongy'. The hollows of 'Spongy' are occupied by vultures and swifts. There are other rocks of note which also have appropriate names. The hills are clad in deciduous forest, the vegetation standing out picturesquely against the masses of grey rock. The plateau, with an average height of nearly 4000 feet, is occupied by the well-known hill station of Mt. Abu—a small patch of territory leased to the British Government by the Sirhoi State. This patch is well demarcated by white boundary pillars standing like sentries on the hills and in the valleys—and richly ornamented with festoons of 'red tape'! Nevertheless it is an 'oasis' in the Rajputana desert, and a delightful place for a holiday. To the naturalist Abu offers a fair range of animal and plant life; to the archeologist some objects of interest; to the photographer and artist some beautiful studies; to the mountaineer many slippery crags; to the squatter many a hard rock! Such is the place I selected for a holiday with my little family. My boys are there at school. But to me Mt. Abu is more than just a place for a holiday. It was there that I was initiated into the mysteries of botany, it was the scene of my first botanical tour in May 1916 in company with my old friends the late Fr. Blatter and Prof. Hallberg—thus Mt. Abu is a mile stone in my biological career.

At the time of my first visit there was no regular bus service, the journey up had to be undertaken in tongas, the luggage coming up in bullock carts. However, on that particular occasion we were lucky to find a solitary blue (I cannot forget the colour) car at Abu Road. Though the vehicle definitely looked more fit for the scrap heap than for a journey up the hills, its enterprising owner volunteered to risk it and promised to be up in a couple of hours. But we had our doubts, grave doubts. As a matter of fact, it took us twelve hours to cover a distance of fifteen miles, for the car broke down for good three miles out of Mt. Abu and we had to

walk the rest of the journey in the dark ! It is the shortest journey I have ever done in the maximum of time ! By the end of May Mt. Abu's first set of omnibuses was in commission ; and now there is a regular service up the Mount.

Fr. Blatter had a special aptitude for teaching a silent, but forceful, lesson ; and at his school I was taught my first botanical lesson and first binomial. In my enthusiasm I made a wild grab at a withering plant and brought it to him. Fr. Blatter looked on, and kept his peace. I had scarcely touched the plant than my hand began to smart ; I scratched it quietly as if there was nothing wrong, but a little later my fingers were on fire, I experienced a most unpleasant sensation. And then very quietly, 'This is *Girardinia heterophylla*, a nettle,' said the old man. The fact that it was a nettle I had already learnt—nor did I forget the binomial. I was to find out in course of time that this nettle will penetrate clothing and is to be given as wide a berth as possible.

On the 7th October (1941) we left Bombay and arrived at Abu Road on the 8th afternoon. There was nothing to report *en route* except that owing to the vagaries of the monsoon this year, the crops appeared to be rather poor. Soon after our arrival at Abu Road we left by bus for the Mount. Everything looked fresh, but the heat and the draught were already changing the grasses from green to khaki. At Chippabari the bus stopped for a breather ; so I decided to stretch my legs. We were already 2000 feet up—a thousand feet above the plain. The first thing that caught my eye was my 'auld acquaintance', *Girardinia*, in fine fettle. The sight of it rushed me back through the years, back to May 1916 and my first botanical lesson. I became reminiscent for a while. My dear old companions returned from the grave, and in fancy we were again together on these hills, but I am the only one left of that 'trinity'. As I walked down the road and looked into the gully between the hills I awakened from my reverie to the presence of clouds of butterflies. The flight seemed abnormal and I stood and watched a while. The insects all seemed to be going in the same direction. Was it a migration flight ? While I was making a mental note of the species involved, the impatience of the bus driver to continue the journey was audibly expressed on his horn. I cursed him, but hurried to put an end to the ear-rending honks. I took my seat, and as we proceeded kept pondering over the flight of the butterflies. In the gully they were probably taking up their positions for the night. When we reached the top there were no signs of them anywhere ; it was already late in the afternoon, long past bed-time in the butterfly world.

After Arna, a police post on the way up, I kept an eye on the cliffs bordering the road for another old acquaintance, this time a sedge, *Eriophorum comosum* Wall. A curious point about this plant is that it appears to favour the northern and north-eastern faces of the cliffs, between 3000 and 3300 ft. Its deep green leaves and cottony inflorescence look pretty against the dark-grey rocks. So far as I can remember, I have not found this sedge elsewhere on these hills. A little higher up, below the toll-bar, willows (*Salix tetrasperma* Roxb.), growing in the rocky bed of a stream, were in full bloom.

At the toll-bar my journey ended. There we found our elder son, Carl, patiently awaiting our arrival to conduct his mother to the house where she was to stay. The sun was now steep in the west, and the vegetation cast long deep shadows. As I threaded my way to the bungalow where I was to stay, I again found myself pondering over the flight of butterflies, only to be disturbed by two mongooses (*Herpestes edwardsii*) fighting on the road, and by the shrill call of the Five-striped Squirrel (*Funambulus pennanti*). There are two species of mongooses occurring on these hills; *H. edwardsii* which ranges from the plain to the top, and *H. smithi* which is confined to the hills. The black tail-tip and darker, brownish coat immediately distinguish this latter species from the Common Mongoose. Of the two, *H. edwardsii* definitely appears to be more predominant. The striped squirrel is extremely common. Passing over an Irish bridge I noticed that the surface of the stream was well-stocked with patches of Whirligig Beetles (*Dineutes indicus* Aube.). They were lazily drifting in batches on the surface of the water, like so many black seeds, but my shadow sent them off girating in all directions, a medley of movement. At length, I reached the bungalow and settled down to a welcome tea amid old friends—all school masters—my hosts. Next day there were to be the school sports, a big function and that fixed the conversation for the evening.

Next morning I was left to myself, so I wandered out into the garden in search of some natural history. At about 9 a.m. the Painted Ladies (¹ *Vanessa cardui* Linn.) commenced to arrive and sail about, like little yachts on the zinnia flowers. Their numbers increased till they were quite plentiful; but towards 4 p.m. all disappeared again to reappear next morning with almost clockwork regularity. Now and again, there was the deep humming sound of a brown day-flying Hawk-moth [*Macroglossum belis* (L.)] or a Bee-hawk (*Cephonodes hylas* L.), both very restive creatures. Of the two *Macroglossum* was by far the commoner. It arrived early, some time between 9 and 9-30 a.m., and visited throughout the day. Towards evening it seemed to be more plentiful but to become much shier as night was setting in. The moths visited the yellow florets of the zinnias, the dahlias, the flowers of the cannas, and a blue acanthaceous plant. Between 9-30 and 10 a.m. commenced the flight of pierids, all going in the same direction. At first the scouts, then larger and larger formations which became exceeding dense between 1-30 and 2 p.m. After this the ranks thinned out rapidly and by 3-30 p.m. the last stragglers had disappeared. It was a definite migration. There was a strong gale blowing, and the insects travelled up wind. Most of them were in a very great hurry, and few ever settled. This procession brought back to me the lines of the immortal Omar:—

‘What, without asking, hither hurried *Whence?*
And, without asking, *Whither* hurried hence!’

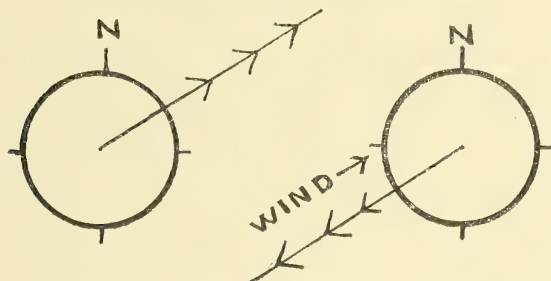
¹ A known migrant.



BUTTERFLIES ON MIGRATION.

Row 1: *Catopsilia pyranthe minna* Herbst. **Row 2:** 2a *C. pyranthe minna*; 2b *C. crocale* subsp. **Row 3:** *C. florella gnoma* F.; **Row 4:** *Ixias marianne* Cr. **Row 5:** *I. pyrene satadra* M. **Row 6:** 6a, 6b. *I. pyrene* ♀♀ without orange tip; 6c, 6d. similar to 6a and 6b but smaller and with less prominent markings on undersidē. **No. 7:** *Huphina nerissa evegate* Cr. **No. 8:** *Belenois mesentina* Cr. (damaged). **No. 9:** *Catopsilia crocale* Cr.

I regretted not having brought my net, but I spent much time catching with my fingers those that settled till I managed to rig up a net from an old mosquito curtain. At lunch I mentioned the flight to my companions and was immediately informed that the



5-7 OCT.

8-17 OCT.

DIRECTION OF FLIGHT OF MIGRATING BUTTERFLIES.

present flight was nothing compared with what had gone before. Further enquiries elicited the fact that the migration commenced on the 5th October, when the insects were travelling in the opposite direction, in clouds! I watched this migration day after day, the numbers gradually diminished and after the 17th of the month there were but a few left behind. These did not seem to be in the same great hurry. I noted that incidentally the wind had also died down. At a rough estimate from 50-80 butterflies crossed a line of 50 yards per minute when the flight was at its peak. The elevation at my point of observation was nearly 4000 ft. The butterflies climbed over the hills, they dropped down into the valleys and up again, but always preserved the direction and never flew more than some 40 or 50 ft. above the ground.

The butterflies involved in this general migration were in order of numbers:—

(1*)	<i>Catopsilia pyranthe minna</i> Herbst.	...	very common
(2*)	<i>Catopsilia florella gnoma</i> F.	...	very common.
(3)	<i>Huphina nerissa evegate</i> Cr.	...	common
(4)	<i>Ixias pyrene satadra</i> Moore	...	common
(5)	<i>Ixias marianne</i> Cr.	...	common
(6*)	<i>Catopsilia crocale</i> Cr.	...	occasional
(7 ¹)	<i>Catopsilia pomona catilla</i> Cr.	...	occasional
(8)	<i>Belenois mesentina</i> Cr.	...	very occasional

Though the majority of *Ixias* kept to the general line of advance some were seen to fly in both the forward and backward directions.

Besides these, **Terias hecabe* L. and **T. libythea* Fab. seemed to follow in the line of flight, but were not plentiful. Among the

¹ Those marked with an asterisk have been recorded as migrants by Mr. Williams.

Ixias there were many females without the orange tip on the forewings.

Among other butterflies caught during the trip were:—**Papilio demoleus* L.; **Danaus limniace* Cr.; *D. plexippus*, a pigmy form; *Precis orithyia* L.; *Atella phalantha* Drury; *Huphina phryne* F.; **Hypolimnas missippus* L. ♀, ♂ seen; and a few Hesperids and Lycaenids.

In volume xl, p. 439 of the *Journal*, Mr. C. B. Williams published an interesting article, *The Migration of Butterflies in India*, in which he enumerated all the known butterfly migrations in the country. In table III of this article, we find that the nearest recorded flight to Mt. Abu is from Deesa, Palanpur State, and was observed by Nurse between 25 and 27 August 1901. The direction of the flight was North-West and the species involved was *Catopsilia pyranthe*, a known migrant. The present record is also of *C. pyranthe mimma*, but accompanied by *C. florella gnoma* in almost equal numbers, and other species.

At dusk the flowers were visited by a few hawk-moths, *Hippotion celerio*; *Nephele didyma*; *Macroglossum*. The first two concentrated chiefly on the cannas.

While standing on the verandha of the bungalow one afternoon I saw a pair of *Danaus lemnice* in copula—nothing extraordinary; but there appeared to be something wrong with the couple. As soon as they settled, I caught them. To my great surprise I discovered that the pendant one, the female, was dead, headless, bone dry, and the wings folded the reverse way! Judging from the condition of the corpse and the worn appearance of the living one, the living insect must have trailed its dead partner about for days! I have seen in collections, insects killed while in copulation; but this is the first time I have come across such an accident in the natural state. This danaid was more common than *D. plexippus* of which I saw a few and caught one—a pigmy.

Atella phalantha Drury seemed to favour *Mallotus* and was seen in plenty round the willows (*Salix tetrasperma* Roxb. in flower) in company with Pierids and Lycaenids. **Papilio demoleus*, as usual, hovered around lime trees while *Huphina* and *Ixias* were partial to *Capparis* spp. and *Vogelia indica* Gibs., this latter only being in flower. *Hamiltonia suaveolens* Roxb. and *Hiptage Madablota* Gaertn. were in full bloom and attracted hosts of Pierids, Lycaenids and the Moth *Macroglossum*. *Kydia calycina* Roxb. was just about to flower.

On the 20th Mr. Gonsalves and I decided on a walk down the road to Arna. There was nothing new in the lepidopterous line so I concentrated more on botany. In a well along the road I found a species of *Lemna* (Duckweed). It covered the entire surface of the water and to my luck found it in flower. This was a good find as I much needed this plant from this area. *Eriophorum comosum* Wall., the sedge, I referred to above, was there in flower and fruit and I was glad to get some fresh material. On the

* Those marked with an asterisk have been recorded as migrants by Mr. Williams.

return journey I heard langurs swearing, and turning to my companion I said 'There is a tiger or panther about'. Barely were the words out of my mouth when we heard a headsmen shouting that a *bhag* (a name for either feline) had killed one of his animals. The following day we set out along the old road which once led down to the plains. On the way we passed a shikar party returning home, after an unsuccessful trip. Off the road lay the body of a young buffalo which had been killed during the night by a tiger. The buffalo had been put out as bait. While on the subject of game, it is interesting to note that tigers and panthers are on the increase. The reason is obvious: tigers are preserved as 'Royal Game'. This increase is not, however, without its repercussions. In years gone by pig and sambhar were fairly plentiful, particularly the former. Today both animals are scarce and in consequence cattle lifting is on the increase to the detriment of the people who must drive their herds into the hills in search of grazing. The felines have become so bold that they will kill in broad daylight. Occasionally a herder is mauled. As there is little other game in these hills the pig and sambhar form the main source of the food supply for these great felines, apart from domestic animals. With the disappearance of the natural food supply these great cats will turn their attention to wholesale slaughter of domestic animals unless steps are taken to thin out their numbers. The sloth bear is also a member of the fauna. This clumsy 'sack of black hair' is well able to hold his own in these hills. There are plenty of retreats and it is a good climber.

Turning from big game to smaller denizens of the wilds, I noticed a remarkable difference in the numbers of the grey jungle fowl (*Gallus sonneratii* Temm.). Formerly these birds were very numerous and they could be heard on all sides heralding the day and keeping up a diurnal concert, but today their familiar note is scarce. To my mind, this decrease is not entirely due to shooting, but to the increase in the mungoose population—a serious menace to ground-breeding birds. In spite of the fact that mungoses keep the reptile fraternity in check, under the circumstances, I would suggest the thinning out of their numbers if the ground-breeding feathered game are to survive. The spur fowl (*Galloperdix s. caurina* Blanford) though still more numerous than the jungle fowl, appears to be fewer in numbers and is likely to share the same fate as its relative. Hares (*Lepus* sp.) are still plentiful. In a restricted area, like the Abu Hills, too strict a preservation must eventually lead to a depopulation of certain types of its fauna, as the food supply is naturally limited. I am afraid I may be treading on somebody's corns, but this is merely my honest opinion as a casual visitor to these hills for many years. As a naturalist I should like to see the fauna of this island in the desert preserved in its proper balance.

Among mammals I must not forget the common langur (*Semnopithecus entellus*) which is much in evidence and occasionally a nuisance. In the heart of the station there is a fairly large colony of flying-foxes (*Pteropus giganteus*) distributed on silver oaks (*Grevillea robusta*) and eucalyptus trees. I was informed that during the cold weather the bats left the hills for a warmer clime. Observations by interested residents on the time of departure

and return of these bats to the hills would be welcome. Hyænas (*Hyaena hyaena*) were occasionally heard but jackals (*Canis indica*) are absent, though common enough on the plain below. Jungle cats (*Felis affinis*) are occasionally seen. Civet cats are not uncommon. Like all other places Mt. Abu has its fair complement of small rodents and bats.

To return to the walk along the old road; we wandered on past the kill till we came to a stream. Here on some almost vertical rocks I spotted a *Begonia* (near *B. trichocarpa* Dalz.) in fruit, which I do not remember having seen before. This was the prize of the day. Just above the *Begonia* was the nest of the house swift (*Micropus affinis affinis* L.) in a pocket in the rock. The bottom of the pocket was built across, and formed the floor of the nest. Internally it was lined with feathers but externally it was composed of pellets of mud. The nest contained a nearly fully fledged young and the male parent. According to the *Fauna* (2nd Ed.): 'They breed from February to September in the Plains and have two or more broods, but in the Hills breed from March to June.' Proceeding from here we passed through plenty of Spear-grass (*Heteropogon contortus* R. & S.) and tufts of Lemon grass (*Cymbopogon Martinii* Stapf). In places dense growths of *Strobilanthes callosus* Nees bordered the narrow path which now formed the road—the forest was reclaiming its own. Tired of picking out spear-grass from our clothes we decided to return home.

On the 22nd I set out on my last walk with my companion. This time we visited a small artificial lake not far from the school. On our way we saw a young monitor lizard (*Varanus monitor*) which quickly disappeared down a crevice between two rocks. Bloodsuckers [*Calotes versicolor* (Daudin)] were plentiful. On arrival at the dam of the lake a mongoose (*H. smithi*) beat a hasty retreat. On examining the shores of the lake I found that they were teeming with the streaked-frog (*Rana lemnocharis* Wiegman) particularly where a little vegetation was coming down to the water's edge. Among some debris left behind by the receding water I found a small frog very beautifully camouflaged. This turned out to be the black-throated frog (*Microhyla ornata* Boulenger). Close examination showed it to be fairly plentiful among the debris, but less common at other points of the lake. This record, I think, is new for this area. The skipper (*Rana cyanophlictis* Schneider) floated leisurely on the surface. In the water were green sponges attached to the rocks, frequently sheltering a crab (*Paratelphusa*) which was frequent in the lake. On the western and north-western shores there were dense growths of *Limnophylla* sp. So dense was the growth in parts that it almost excluded all else. It was in flower, and attracted crowds of butterflies, chiefly Pierids. The *Limnophylla* sheltered hundreds of the streaked-frog. Lastly there appeared the common skink (*Mabuya carinata*) which attempted to keep out of my way, but soon found itself in my collecting bag.

Mt. Abu has its full share of avian fauna, but I will only mention some of its outstanding birds. The first large bird the visitor meets as he enters the station, is Pharaoh's chicken [*Neophron p. ginginianus* (Lath.)] to give it its polite name, in its various stages

of plumage; from the brown juvenile dress with a bluish beak to the white adult plumage with a yellow bill. Going into the station is like entering by the back door. The first points of interest the visitor passes by are the rubbish heaps and incinerators, hence the presence of Pharaoh's chicks. On the roads most vehicular traffic is strictly banned, but as with all bans there is a privileged class exempt. Generally speaking they are the 'upper ten' but in this case it is the 'lower thousand'! The privileged class is the ungainly, wobbly night soil carts that are the favoured ones—all wending their way in slow, leisurely procession to their decanting station. Their approach is a signal to the wayfarers to hold their noses, and a spitting competition by the locals! The 'monsters' are still more offensive to the nostrils than ungainly to the eye. The pariah kite (*Mitvus govinde*) is common and is seen in company with Pharaoh's chickens. The fulvous vulture (*Gyps fulvus* Hume) is a common bird and is often seen near the refuse dumps. It breeds commonly in the numerous pockets in the crags. The jungle crow (*Corvus macrorhynchus* Wagn.) is in ample evidence and replaces on these hills his next of kin, the common crow (*C. splendens*), though the latter is plentiful in the plains and on the lower slopes.

Carrion feeders are not the only birds in Mt. Abu, there are many more of delightful plumage and delicate taste. The common bulbul [*Molpastes cafer* (L.)] is very numerous and at the time was engaged on parental duties. I saw numerous fledged young following their parents. The red-whiskered bulbuls (*Otocompsa jocosa*) were fewer. Three kingfishers, the white-breasted [*Halcyon smyrnensis fusca* (Bodd.)], the pied (*Ceryle rudis leucomelanura* Rech.) and the little kingfisher [*Alcedo atthis* (L.)] haunted the streams. The hoopoe, I did not see. I mention this fact because I have seen it during the winter. The jungle babbler (*Turdoides somervillei sindianus* Ticehurst) noisily hunted in the bushes and undergrowth. Bush Robins strutted about the grass or perched on rocks. In winter there is a general influx of birds of prey and other migrants.

I must now make a few observations on the flora. I have already remarked on the type of vegetation. The currunda (*Carissa carandas* Linn.) seems to predominate, and in the season its sweet-scented flowers give the air a delightful aroma. A plant which, I think, is becoming a serious pest, is a thorny straggling shrub, *Caesalpinia sepiaria* Roxb. It is definitely gaining ground. The foliage is beautiful enough, and the lemon-coloured flowers lend a touch of colour, but the ugly recurved thorns are a nuisance. It is easily distinguished by its boat-shaped pods which often persist for a considerable time on the bushes. Another plant which appears to be threatening the station is a Composite, *Xanthium strumarium* L. I do not remember having seen it here in such abundance as this year. The area round the rubbish heaps and the gutters along the roadside in certain places are overrun with it. It is common enough in the plain and is spreading far and wide along the railway track. This same plant has entered Salsette Island and I first saw it along the railway track at Santa Cruz where I feel sure it was introduced by the railway! Since its first

introduction into Salsette, it is spreading rapidly. The fruits form dense clusters and are armed with numerous hooks which make them suitable for animal or human dispersal. The nettle, *Girardinia heterophylla* Dalz., already referred to, is a hideous pest. Certain gullies and damp places in the hills are filled with a tough grass, *Pennisetum Alopecuros* Nees, which is used locally to make rope. Cattle do not seem to touch it. Perhaps with a little care this grass could be put to a greater use than at present.

The tallest trees in the area are Australian, *Eucalyptus* and silver oak (*Grevillea robusta*). A few peepal (*Ficus religiosa* L.) and Banyan (*F. bengalensis* L.) have also attained great size. Some specimens at Chippabari are fine examples of the latter. A *Bauhinia* (*B. purpurea* L.) makes a fine show when in flower not far below the toll-bar. *Erythrina* spp. with their scarlet flowers are also attractive in the season and lend a touch of colour to the hills. I must not omit mentioning the *Euphorbia* bushes (often erroneously referred to as cactus bushes—true *Cactus* is purely American. On the plain and the lowest slopes the round stemmed *Euphorbia nerifolia* Linn. is the only one seen, but at the top the angular stemmed *E. ligularia* Roxb. is in sole possession! Why there should be this difference is yet to be disclosed. Altitude is not the explanation as the second species also occurs at sea level. Another question is—How did it get to the mount when it is surrounded on all sides by the round stemmed species?

Garden escapes are not uncommon. The beautiful potato creeper (*Solanum*) is now running wild in certain places. The dispersal of this plant I lay at the door of the common bulbul (*Molpastes cafer*) which eats the ripe berries. An *Ageratum* with fluffy, pale blue flowers, an introduction, is slowly gaining ground in damp places. *Zinnia* and an orange-yellow cosmos-like plant are also seen as escapes.

Lastly, mention is to be made of the mango (*Mangifera indica*) species of *Anogeissus* and the Jambul (*Eugenia Jambolana* Lam.) which here and there form a goodly percentage of the shade trees.

On the 23rd evening we bundled into a bus after saying farewell to our kind hosts and our two boys, as we had decided on a day's stay at Abu Road. Nothing of note occurred en route except that about six miles out of Abu Road we saw a panther sitting on the parapet wall of the road. It was dark when we arrived. That night I noticed a number of toads entering the house. Being so plentiful, I at first took them to be the common toad (*Bufo melanostictus* Schneider), but they did not look as warty as usual. My interest in these creatures amused my friends, but when I commenced collecting them with my hands, my audience was horrified and then commenced a series of fabulous stories. I smiled, and tried to explain some of the beliefs, but fiction is more palatable than truth. The net result of my explanations ended in the comment that I possessed some uncanny power which protected me from harm! A toad is a harmless creature if handled gently. Only rough treatment ruptures the warts on the skin which exude a thick milky secretion with a very powerful acrid smell. At most it may cause a slight irritation, but if the affected parts are washed immediately there are no ill effects.

This common toad turned out to be Anderson's toad (*Bufo andersoni* Boulenger), a species widely distributed in Rajputana. Among the toads I captured were also a couple of the common toad, but Anderson's was by far the commoner of the two. During the day they live in hollow masonry, numbers huddling together in the same hollow. At dusk they emerge and make for water or damp spots. In such places they sit for a considerable time with the lower surface pressed to the ground, absorbing water all the time. The skin is soon distended with a quantity of water—the supply for the next 24 hours. Such specimens when handled are able to eject a certain amount of the water through the cloaca. The toads and frogs do this to 'lighten' themselves so as to be able to jump more effectively. This habit is quite naturally interpreted by the 'vulgar' as urinating, and 'God help you if you get any of it on you!' So say all of us! This is a common belief. Actually the water exuded is *aqua pura* as it was absorbed through the skin which acts as a perfect filter. Dissection indicated that the genital organs were becoming active. During the cold season these animals 'disappear' to their winter quarters to reappear when the weather is more favourable. They breed chiefly during the rains. Anderson's toad appears to be much more active than the common toad, and looks less like a 'contented profiteer'! It does not grow so large, is far less warty, and is devoid of the strong bony ridges on the head which give the common toad its 'beetling brows'. The common toad is common on the Mount, but I have not seen Anderson's toad up there¹.

On the 25th afternoon we left Abu Road for Bombay—*Au revoir* Abu, I may come back some day! In conclusion I must express our best thanks to our hosts up at the Mount and in the plain for the very pleasant holiday, 'busman's holiday' though it was—that is the worst of a man with a job and a hobby in the same profession! Any way, thank God it is so! I am happy—a naturalist is never alone in the world; he can always converse with Nature, where others, less fortunate than himself, are lost.

A LIST OF SOME OF THE ANIMALS NOTED.

MAMMALS:—

Semnopithecus entellus

Pteropus giganteus

Panthera tigris

Panthera pardus

Felis chaus

Hyaena hyaena

Herpestes edwardsii

Herpestes smithi

Funambulus pennanti

Acanthion leucurus

Lepus

A large colony in the station.

} Common—traces everywhere.

Common on the plain but less frequent on the hills.

Common on the plain and on the hills.

Very common on the plains and on the hills.

Restricted to the forested areas on the hills.

Very common.

¹ I have since taken specimens on the Mount.

Paradoxurus niger
Rusa unicorn
Sus cristatus
Melursus ursinus
Canis indicus

BIRDS:—

Corvus m. macrorhynchus
Corvus s. splendens
Turdoides somervillei sindianus
Pomatorhinus horst. obscurus
Molpastes cafer
Olocompsa jocosa
Halcyon s. fusca
Alcedo atthis
Ceryle rudis leucomelanura

Micropus a. affinis

Upupa epops
Gyps fulvus fulvescens

Neophron p. ginginianus
Milvus govinda
Galloperdix s. caurina
Gallus sonnerati
Lobivanellus i. indicus
Passer domesticus

REPTILES:—

Ptyas mucosus
Tropidonotus piscator
 „ *plumbicolor*
Naia tripudians
Vipera russellii
Hemidactylus flaviviridis
Hemidactylus brookei

Calotes versicolor
Varanus bengalensis

AMPHIBIA:—

Rana tigrina
Rana cyanophlictis
Rana limnocharis
Microhyla ornata
Bufo melanostictus

Bufo andersoni

Frequent.

Frequent.

Present on the plains but not on the hills.

Common on the hills.

Common on the plains.

Common.

Not uncommon on the hills.

Very common. Breeding.

Frequent.

} Common.

Commoner on the plains than on the hills.

Common among the rocks—breeding.

Apparently a visitor.

A common species breeding in suitable places on the crags.

Very common—breeding.

Very common.

Quite common.

Less common than formerly.

Common along water courses.

Very common.

Quite common.

Very common.

Common—somewhat nocturnal.

} Common on the hills.

In houses.

In houses and outside on trees etc.

Common.

Common.

} All these either seen or taken on the hills and on the plain excepting *M. ornata* which was only taken on the hills—4,000 ft.

Common on the hills and plain.

Only taken on the plain¹.

¹ Since writing taken on the Mount.

INSECTS, Butterflies :—

*Papilio demolius**Catopsilia crocale*" *pyranthe minna*" *florella gnoma*" *pomona catilla**Ixias pyrene saladra*" *marianne**Belenois mesentina**Huphina n. evagete*" *phryne**Danaus limniace*" *plexippus**Vanessa cardui**Precis orythia**Hypolimnas missippus**Terias hecabe*" *libythea**Atella phalantha**Tarucus plinius*

MOTHS :—

*Actias selene**Hippotion celerio**Nephele didyma**Macroglossum belis**Cephonodes hylas**Acherontia styx*

BEETLES :—

*Dineutes indicus**Anatoma stillata**Chiloloba acuta**Cliuteria klugi**Scarabaeidae*

Frequenting citrus plants.

Frequenting a Labiate.

Frequenting *Mallotus* sp. and
Salix tetrasperma in flowers.

} Visiting Cannas.

The commonest day-flying
moth.Occasional visitor during the
day.Feeding on a grass, *Cymbopogon Martini* Staff at Oria.Feeding on a grass, *Pennisetum Alopecuros*.Feeding on a grass, *Heteropogon contortus*.Species of this family are
common.

FISH OF POONA.

PART II.

BY

S. L. HORA, D.SC., F.R.S.E., F.N.I., and K. S. MISRA, M.SC.

(Continued from page 91 of this volume).

(With one text-figure).

LIST OF FISHES WITH THEIR HINDI NAMES AND DISTRIBUTION¹.

In the first article of this series, Fraser² gave a general account of the Poona waterways with descriptions of localities and lists of fishes collected from each, and here we give a complete systematic list of the species represented in the material along with their respective Hindi names and further distribution. Notes on the taxonomic position of certain species are included at the end. In preparing the list we have adopted the classification proposed by Jordan³ and have given Hindi names collected by Mr. Fraser from 'Pardeshi Boies'. It will be seen that different species are sometimes called by the same name and that one species may sometimes have several different names. In making collections of fish, therefore, much reliance cannot be placed on the vernacular names given to various species. Limits of the distribution of each species are given with a view to show the geographical relationships of the fauna as a whole. Most of the species are widely distributed while a few are restricted to the Western Ghats and the neighbouring hill ranges.

The occurrence of *Schizmatorhynchus* Bleeker and *Mystacoleucus* Gunther is of special significance; besides the Western Ghats, the former is found only in the Malay Archipelago, while the latter is found in Burma, Siam, Malaya, etc. but nowhere else in India. These two genera show the Malayan affinities of the fauna of this part of the Western Ghats. *Labeo boggut* (Sykes) has also been recorded from the Malaya, but this requires further confirmation.

¹ Published with permission of the Director, Zoological Survey of India.

² Fraser, A. G. L., *Journ. Bombay Nat. Hist. Soc.*, xlii, pp. 79-91, (1942).

³ Jordan, D. S., *Classification of Fishes* (Stanford University: California: 1923).

SCIENTIFIC NAMES	HINDI NAMES	FURTHER DISTRIBUTION
Order : ISOSPONDYLI Family : NOTOPTERIDAE		
1. <i>Notopterus notopterus</i> (Pallas) ...	Chalut.	India, Burma, Siam, Malay Peninsula, Malay Archipelago, Southern China (Yunnan) and Indo-China.
Order : OPISTHOMI Family : MASTACEMBELIDAE		
2. <i>Mastacembelus armatus</i> (Lacép.) ...	Bam.	Ceylon, India, Burma, Malaya, Siam, East Indies and China.
Order : APODES Family : ANGUILLIDAE		
3. <i>Anguilla bengalensis</i> (Gray) ... = <i>Anguilla elphinstoni</i> Sykes.	Aheer.	Ceylon, India, Burma, Java and Celebes.
Order : EVENTOGNATHI Family : CYPRINIDAE		
Subfamily : <i>Abramidiinae</i>		
4. <i>Chela boopis</i> Day. ...	Barwah, Peurah, Barwa, Chindoor, Barwah, Amblee.	South Canara and ? Mysore.
5. <i>Chela clupeioides</i> (Bl.) ...	Amblee, Kala Shurath.	Cutch, Peninsular India, Satpura Trend and Burma.
6. <i>Chela phulo</i> Ham. ...	Barwah, Phalgah, Ambli, Sufed Powwul, Kala Barwa, Kala Pirwah, Peurah, Dhan-sahree, Kala Ambli, Peelah Pirwah, Sufed Barwa, Peelah Powwul.	Assam, Bengal, Orissa, Central India, Deccan and as far southwards as the Tungabhadra and Kistna rivers.
Subfamily : <i>Rasborinae</i>		
7. <i>Barilius barna</i> Ham. ...	Theenohr.	Mysore, Orissa, Bengal, Assam and Burma.
8. <i>Danio aequipinnatus</i> (McClelland) ...	Thook Chatee, Dhandawah, Dhan, Bhatar-see.	Ceylon, India, Burma and Siam.
9. <i>Rasbora daniconius</i> (Ham.) ...	Loodeah, Ranjannah, Dhandawah.	Ceylon, India, Burma, Malay Peninsula, Southern China and Indo-China.

SCIENTIFIC NAMES	HINDI NAMES	FURTHER DISTRIBUTION
Subfamily : <i>Cyprininae</i>		
10. <i>Barbus (Puntius) amphibius</i> (C.V.)	...	Ceylon and Peninsular India.
11. <i>Barbus (Puntius) chola</i> (Ham.) ...	Danghar, Jhirwah, Bhatarseo, Dhan. Dhunsahree, Chulliah, Ghaar, Sahkar Massah, Dagh.	Ceylon, India, Burma, China and Indo- China.
12. <i>Barbus (Puntius) jerdoni</i> Day. ...	'Barsa', Secrahta, Soorookh, Gooroond, Khadra, Sufed Puree Khadree, Pahsoor.	South Canara and Deccan.
= <i>Barbus dobsoni</i> Day.	...	
= <i>Barbus pulchellus</i> Day.	...	
= <i>Barbus jerdoni maciveri</i> Annandale	...	
13. <i>Barbus (Puntius) kolus</i> Sykes. ...	Kholus, 'Kholas', Rahoos, Tahrak, Kala Kholus.	Deolali, Central Provinces, Deccan and throughout the Kistna and Tungabhadra and Godavari rivers.
14. <i>Barbus (Puntius) sarana</i> (Ham.)	...	Ceylon, throughout India, Burma and China.
= <i>Barbus (Puntius) chrysopoma</i> C.V.	Lall Purree Khadrie, Safed Puree Khadrie, Shoor, Soorookh, Kangoor, Kharook, Pahrand, Lall Pahraas, Shaar.	
= <i>Barbus (Puntius) pinnauratus</i> Day.	Debree, Chatee Debrie, Koondah.	
15. <i>Barbus (Puntius) ticto</i> Ham. ...	Phirkee, Barsa, Dart.	Ceylon, India, Burma and Siam.
16. <i>Barbus (Tor) khudree</i> Sykes. ...	...	Ceylon, Peninsular India, Deccan and Satpura Trend.
17. <i>Cirrhinia fulungee</i> (Sykes) ...	Lowlee, Powndah, Preeth, Peelah Soorookh, Peela Kholus, Soorkee, Dheer, Phirkee, Peelah Shurath, Soor, Ghoree. Lahoor, Looddeah, Nahmooneah.	Mysore and Deccan.
18. <i>Crossochilus latius</i> (Ham.) ...	...
19. <i>Garra mulya</i> (Sykes) ...	Mallia, Mallah, Nakhta Mallia, Kala Shurath.	The Ganges and the Brahmaputra systems in Northern India and Peninsular India.
20. <i>Labeo boggut</i> (Sykes) ...	Gonrah, Ghor.	Kathawar, Peninsular India and the Sat- pura Trend.
21. <i>Labeo calbasu</i> (Ham.) ...	...	Central and South-west India generally and also in Malaya.
22. <i>Labeo fimbriata</i> (Bl.) ...	Cowchee, Tamthee.	India, Burma and China. Sind, Punjab, Southern India at least to Orissa, probably N. E. Bengal; not recorded from Malabar and Canara.

23.	<i>Labeo potail</i> (Sykes) = <i>Labeo portallus</i> (Heckel)	... ...	'Tamthee', Lahhoor, Khandwee, Ghobree, Cowwool, Preeth, Cowchee, Shook, Tooth, Jhawal, Gobrie, Chakta, Talmoshee, Thamooshee. Bakhar Massah.	Ceylon and Peninsular India.
24.	<i>Mystacoleucus ogilbii</i> (Sykes) ¹	...	...	Deccan, the Kistna and Godavari rivers.
25.	<i>Parapsilorhynchus tentaculatus</i> (Annan.) ²	...	...	Satpura Trend as far as Pachmarhi.
26.	<i>Rohtee cofio</i> var. <i>cunna</i> Day ³	...	...	Sind, Deccan, Orissa, Assam and Burma.
27.	<i>Rohtee neilli</i> Day	...	...	Deccan and Travancore.
28.	<i>Rohtee vigorsii</i> Sykes	...	...	Deccan, Kistna and Godavari rivers to their terminations.
29.	<i>Schiznatorhynchus</i> (Nukta) nukta (Sykes) ⁴	...	Dhotowandee.	Mysore and rivers of the Deccan.
30.	Family : COBITIDÆ <i>Lepidocephalus guntea</i> (Ham.)	...	Mohra gotia.	Throughout India (except to the south of the Kistna and along the Malabar coast).
31.	<i>Nemachilichthys ruppelli</i> (Sykes)	...	Sondeah Garah.	Deccan.
32.	<i>Nemachilus botia</i> var. <i>aureus</i> Day	...	Gotia Garah, Moorah gotia, Mohroogotia.	Deccan, Assam, upper portions of the Ganges and Jumna rivers.
33.	<i>Nemachilus dayi</i> Hora ⁵	...	Thaylia, Kala Moorong.	
34.	Order : NEMATOGNATHII Family : SILURIDÆ <i>Callichrous bimaculatus</i> (Bl.)	...	Goongwaree.	Ceylon, India, Burma, Siam, Java, Bornéo, Chusan, Yunnan and Indo-China.
35.	<i>Callichrous pabo</i> (Ham.)	...	'Goongwaree', Kallie Goongwaree.	Jumna and Ganges rivers, Burma and Indo-China.
36.	<i>Wallagonia attu</i> (Bl.)	...	Pahree.	Ceylon, India, Burma, Siam, Java, Sumatra and Western Yunnan.
37.	Family : BAGRIDÆ <i>Mystus cavasius</i> (Ham.)	...	Tengnah, Kala Tengnah, Singhara.	India, Burma, Siam, China and Indo-China.

¹ Hora, S.L., *Rec. Ind. Mus.*, XXXIX, pp. 311 (1937).² Hora, S.L., *Rec. Ind. Mus.*, XXVII, p. 457 (1925).³ Hora, S.L. and Misra, K.S., *Rec. Ind. Mus.*, XLII, pp. 168-171 (1940).⁴ Hora, S.L., *Rec. Ind. Mus.*, XLIV, pp. 1-14 (1942).⁵ Hora, S.L., *Rec. Ind. Mus.*, XXXVII, p. 57 (1933).

SCIENTIFIC NAMES	HINDI NAMES	FURTHER DISTRIBUTION
Subfamily: <i>Cyprininae</i>		
10. <i>Barbus (Puntius) amphibius</i> (C.V.)	... Danghar, Jhirwah, Bhatarseo, Dhan.	Ceylon and Peninsular India.
11. <i>Barbus (Puntius) chola</i> (Ham.)	... Dhunsahree, Chulliah, Ghaar, ' Sahkar Massah, Dagb.	Ceylon, India, Burma, China and Indo-China.
12. <i>Barbus (Puntius) jerdoni</i> Day.	... 'Barsa', Seerahta, Soorookh, Gooroond, Khadra, Sufed Puree Khadree, Pahsoor.	South Canara and Deccan.
13. <i>Barbus (Puntius) kolus</i> Sykes.	... Kholus, 'Kholas' Rahoos, Tahrak, Kala Kholus.	Deolali, Central Provinces, Deccan and throughout the Kistna and Tungabhadra and Godavari rivers.
14. <i>Barbus (Puntius) sarana</i> (Ham.)	... Lall Purree Khadrie, Safed Puree Khadrie, Shoor, Soorookh, Kangoor, Kharook, Pahrand, Lall Pahress, Shaar.	Ceylon, throughout India, Burma and China.
15. <i>Barbus (Puntius) ticto</i> Ham.	... Debree, Chatee Debree, Koondah.	Ceylon, India, Burma and Siam.
16. <i>Barbus (Tor) khudree</i> Sykes.	... Phirkee, Barsa, Dart.	Ceylon, Peninsular India, Deccan and Satpura Trend.
17. <i>Cirrhina fulungee</i> (Sykes)	... Lowlee, Powndah, Preeth, Peelah Soorookh, Peela Kholus, Soorkee, Dheer, Phirkee, Peelah Shurath, Soor, Ghoree.	Mysore and Deccan.
18. <i>Crossocheilus latius</i> (Ham.)	... Laboor, Loodeah, Nahmooneah.	The Ganges and the Brahmaputra systems in Northern India and Peninsular India.
19. <i>Garra mullya</i> (Sykes)	... Mallia, Mallah, Nakhta Mallia, Kala Shurath.	Kathiawar, Peninsular India and the Sat- pura Trend.
20. <i>Labeo boggut</i> (Sykes)	... Gohrah, Ghor.	Central and South-west India generally and also in Malaya.
21. <i>Labeo caibasu</i> (Ham.)	... Cowchee.	India, Burma and China.
22. <i>Labeo fimbriata</i> (Bl.)	... 'Tamthee.	Sind, Punjab, Southern India at least to Orissa, probably N. E. Bengal; not recorded from Malabar and Canara.
23. <i>Labeo potail</i> (Sykes)	... 'Tamthee', Lahhoor, Khandwee, Ghobree, Cowwood, Preeth, Cowchee, Shook, Tooth, Jhawal, Gobrie, Chakta, Tahmoshee, Thamooshee.	Ceylon and Peninsular India.
24. <i>Mystacoleucus ogilbil</i> (Sykes) ¹	... Bakhar Massah.	Deccan, the Kistna and Godavari rivers.
25. <i>Parapsilorbynchus tentaculatus</i> (Annan.) ²	...	Satpura Trend as far as Pachmarhi.
26. <i>Rohitee catlo</i> var. <i>cunna</i> Day ³	... Deotee, Goordee.	Sind, Deccan, Orissa, Assam and Burma.
27. <i>Rohitee neilli</i> Day	... Deotee	Deccan and Travancore.
28. <i>Rohitee vlgorsii</i> Sykes	... Goordee.	Deccan, Kistna and Godavari rivers to their terminations.
29. <i>Schizmatobryanchus (Nnktia) nukta</i> (Sykes) ⁴	... Dhotowandee.	Mysore and rivers of the Deccan.
Family: COBITIDAE		
30. <i>Lepidocephalus guntea</i> (Ham.)	... Mohra gotia.	Throughout India (except to the south of the Kistna and along the Malabar coast).
31. <i>Nemachilichthys ruppelli</i> (Sykes)	... Soondeah Garah.	Deccan.
32. <i>Nemachilus botla</i> var. <i>aureus</i> Day	... Gotia Garah, Moorah gotia, Mohroogotia.	Deccan, Assam, upper portions of the Ganges and Jumna rivers.
33. <i>Nemachilus dayi</i> Hora ⁵	... Thaylia, Kala Moorong.	
Order: NEMATOGNATHII		
Family: SILURIDAE		
34. <i>Callichrous bimaculatus</i> (Bl.)	... Goongwaree.	Ceylon, India, Burma, Siam, Java, Borneo, Chusan, Yunnan and Indo-China.
35. <i>Callichrous pabo</i> (Ham.)	... 'Goongwaree', Kalie Goongwaree.	Jumna and Ganges rivers, Burma and Indo-China.
36. <i>Wallagonia attu</i> (Bl.)	... Pahree.	Ceylon, India, Burma, Siam, Java, Sumatra and Western Yunnan.
Family: BAGRIDAE		
37. <i>Mystus cavasius</i> (Ham.)	... Tegnah, Kala Tegnah, Singhara.	India, Burma, Siam, China and Indo-China.

¹ Hora, S.L., *Rec. Ind. Mus.*, XXXIX, pp. 311 (1937).² Hora, S.L., *Rec. Ind. Mus.*, XXVII, p. 457 (1925).³ Hora, S.L. and Misra, K.S., *Rec. Ind. Mus.*, XLII, pp. 168-171 (1940).⁴ Hora, S.L., *Rec. Ind. Mus.*, XLIV, pp. 1-14 (1942).⁵ Hora, S.L., *Rec. Ind. Mus.*, XXXVII, p. 57 (1933).

SCIENTIFIC NAMES	HINDI NAMES	FURTHER DISTRIBUTION
38. <i>Mystus gulio</i> (Ham.)	... Kala Tegnah.	Ceylon, India, Burma, Siam, Malay Peninsula, Malay Archipelago and Indo-China.
39. <i>Mystus senegalensis</i> (Sykes)	... Chotkah.	India, Burma and China.
40. <i>Rita hastata</i> (Val.)	... 'Googoorah'.	Deccan, the Tungabhadra and the Kistna rivers.
41. <i>Rita pavimentata</i> (Val.)	... 'Padmna'.	Deccan, affluents of the Kistna.
42. <i>Gagata itcheke</i> (Sykes). ¹	... Phather Chatoo.	Deolali, Satara and the Cauvery in the Coorg State.
43. <i>Glyptothorax confirostre</i> var. <i>poonaensis</i> Hora. ²	...	Poona and its environs.
44. <i>Glyptothorax lonah</i> (Sykes)	...	Deccan, Godaveri river near Nasik and Bastar State (Central Provinces).
45. <i>Proeutropichthys taakree</i> (Sykes) ³	...	Peninsular India (except Malabar coast), Burma and ? Calcutta.
46. <i>Silonopangasius childrenii</i> (Sykes) ⁴	...	Deccan.
Order: CYPRINODONTES Family: CYPRINODONTIDAE		
47. <i>Aplochilus lineatus</i> (C.V.)	...	Ceylon, Peninsular India and Deccan.
Order: SYNGNATHI Family: XENENTODONTIDAE		
48. <i>Xenentodon canila</i> (Ham.)	...	Ceylon, India, Burma, Siam, Malaya and Indo-China.
Order: LABYRINTHICI Family: OPHICEPHALIDAE		
49. <i>Ophicephalus gachua</i> (Ham.)	...	Baluchistan, Afghanistan, Ceylon, India, Burma, Malay Peninsula, Siam, Malaya, Archipelago, Yunnan, Hainan and Indo-China.

50. <i>Opticephalus tencopunctatus</i> (Sykes)	...	Mural.	Peninsular India, Deccan, and also said to be found in China.
51. <i>Opticephalus marulius</i> (Ham.)	...	Powndah, Mural.	Ceylon, India, Burma, Siam and China.
Order: PERCOMORPHI Family: AMBASSIDAE			
52. <i>Ambassis ranga</i> (Ham.)	...	Khardoo, Chandwah.	India, Burma, Malay and Siam.
Order: GOBIOIDEA Family: Gobiidae			
53. <i>Glossogobius giuris</i> (Ham.)	...	Kharpa.	East Africa, Ceylon, India, Burma, Malay Peninsula, Malay Archipelago, Siam, China, Indo-China, Wake Island, Australia and Tahiti.

¹ Hora, S. L. and Law, N. C., *Rec. Ind. Mus.*, XLIII, pp. 18-20 (1941)

² Hora, S. L., *Rec. Ind. Mus.*, XL, pp. 368-370 (1938).

³ Hora, S. L., *Rec. Ind. Mus.*, XLIII, pp. 105-110 (1941).

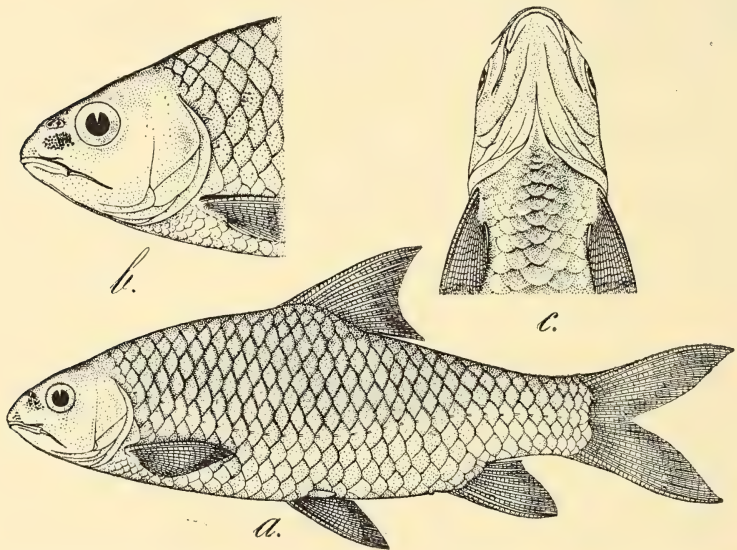
⁴ Hora, S. L., *Rec. Ind. Mus.*, XLIII, pp. 98-100 (1941).

SCIENTIFIC NAMES			HINDI NAMES	FURTHER DISTRIBUTION
38.	<i>Mystus gullo</i> (Ham.)	...	Kala Tengnah.	Ceylon, India, Burma, Siam, Malay Peninsula, Malay Archipelago and Indo-China.
39.	<i>Mystus seenghela</i> (Sykes)	...	Chootkah.	India, Burma and China.
40.	<i>Rita hastata</i> (Val.)	...		Deccan, the Tungabhadra and the Kistna rivers.
41.	<i>Rita pavimentata</i> (Val.)	...	'Googoorah'.	Deccan, affluents of the Kistna.
Family: SISORIDAE				
42.	<i>Oagata itchkeea</i> (Sykes), ¹	...	'Padhnah'.	Deolali, Satara and the Cauvery in the Coorg State.
43.	<i>Glyptothorax confrostre</i> var. <i>poonaensis</i> Hora, ²	...	Phather Chatoo.	Poona and its environs.
44.	<i>Glyptothorax ionah</i> (Sykes)	...		Deccan, Godavari river near Nasik and Bastar State (Central Provinces).
Family: SCHILBEIDAE				
45.	<i>Procutropichthys taakree</i> (Sykes) ³	...	Moonia.	Peninsular India (except Malabar coast), Burma and? Calcutta.
Family: PANGASIDAE				
46.	<i>Stenopangasius childreni</i> (Sykes) ⁴	...	Seelundh.	Deccan.
Order: CYPRINODONTES				
Family: CYPRINODONTIDAE				
47.	<i>Aplocheilichthys lineatus</i> (C.V.)	...	Jhir, Konkani Garah.	Ceylon, Peninsular India and Deccan.
Order: SYNNENTOGNATHI				
Family: XENENTODONTIDAE				
48.	<i>Xenentodon canila</i> (Ham.)	...	Denghwah.	Ceylon, India, Burma, Siam, Malaya and Indo-China.
Order: LABYRINTHICI				
Family: OPHICEPHALIDAE				
49.	<i>Ophicephalus gachua</i> (Ham.)	...	Dhakoo, Murrul.	Baluchistan, Afghanistan, Ceylon, India, Burma, Malay Peninsula, Siam, Malaya, Archipelago, Yunnan, Hainan and Indo-China.
50.	<i>Ophicephalus teucopunctatus</i> (Sykes)	...	Murrul.	Peninsular India, Deccan, and also said to be found in China.
51.	<i>Ophicephalus marullus</i> (Ham.)	...	Powndah, Murrul.	Ceylon, India, Burma, Siam and China.
Order: PERCOMORPHI				
Family: AMBASSIDAE				
52.	<i>Ambassis ranga</i> (Ham.)	...	Khardoo, Chandwah.	India, Burma, Malay and Siam.
Order: GOBIOIDEA				
Family: GOBIIDAE				
53.	<i>Glossogobius giuris</i> (Ham.)	...	Kharpa.	East Africa, Ceylon, India, Burma, Malay Peninsula, Malay Archipelago, Siam, China, Indo-China, Wake Island, Australia and Tahiti.

¹ Hora, S. L. and Law, N. C., *Rec. Ind. Mus.*, XLIII, pp. 18-20 (1941).² Hora, S. L., *Rec. Ind. Mus.*, XL, pp. 368-370 (1938).³ Hora, S. L., *Rec. Ind. Mus.*, XLIII, pp. 105-110 (1941).⁴ Hora, S. L., *Rec. Ind. Mus.*, XLIII, pp. 98-100 (1941).

Barbus (Puntius) jerdoni Day.1870. *Barbus Jerdoni*, Day, *Proc. Zool. Soc. London*, p. 372.1870. *Barbus pulchellus*, Day, *Proc. Zool. Soc. London*, p. 372.1876. *Barbus Dobsoni*, Day, *Journ. Linn. Soc. London (Zool.)*, xii, p. 574.1919. *Barbus jerdoni* var. *maciveri*, Annandale, *Rec. Ind. Mus.* xvi, p. 137.

From a detailed study of the material, including types, of the above listed three species and one variety in the collection of the Indian Museum, we find that the descriptions of *Barbus jerdoni* and *B. dobsoni*, characterised by a smooth snout, are based on female specimens, whereas the other two forms with tubercles on the snout represent male individuals. An examination of a large series of specimens has shown that there are no other valid differences between these species and that the characters on which they have been dis-



Text-fig. 1.—A male specimen of *Barbus (Puntius) jerdoni* Day, showing patches of tubercles on the snout.

a. Lateral view. $\times \frac{1}{2}$; b. Lateral view of head and anterior part of body. $\times \frac{3}{4}$; c. Ventral view of head and anterior part of body. $\times \frac{3}{4}$.

tinguished intergrade. Except that the two sexes can be readily distinguished in the adult condition on the presence or absence of tubercles on the snout, we have not been able to find any other character to recognise them specifically.

Barbus (Puntius) sarana (Hamilton).1822. *Cyprinus sarana*, Hamilton, *Fish. Ganges*, pp. 307, 388.

1842. *Barbus chrysopoma*, Cuvier and Valenciennes, *Hist. Nat. Poiss.*, xvi, p. 165, pl. ccclvi.

1865. *Puntius pinnauratus*, Day, *Fish. Malabar*, p. 209, pl. xv, fig. 2.

Several authors, including Day, *Fish. India*, p. 562 (1878), have commented on the close similarity between *Barbus sarana*, *B. chry-*

sopoma and *B. pinnauratus*. After an examination of large series of specimens of these three species in the collection of the Indian Museum from India and Burma, we are definitely of the opinion that they are synonymous. We have, however, found that the specimens occurring in northern India possess more scales along the lateral line (32-34) and in front of the dorsal fin (12) than those found in southern India and Burma (L. 1. 28-32; predorsal 10-12). This is significant, for a similar reduction in the number of scales has also been observed in the case of the Burmese and South Indian specimens of *Puntius ticto*¹, *Rohtee cotio*² and *Lissocheilus hexagonolepis*³.

Labeo potail (Sykes).

1841. *Cyprinus potail*, Sykes, *Trans. Zool. Soc. London*, ii, p. 354.

1844. *Tylognathus porcellus*, Heckel, *Fische Kaschmir*, p. 385.

From an examination of a large number specimens of different sizes, we have found that in the young and half-grown individuals the rostral barbels, though small, are fairly well-marked. In older specimens these barbels are reduced or are totally absent. In some specimens only one rostral barbel is present. The maxillary barbels are small and are situated in deep grooves; on account of their small size and position, they are likely to be overlooked. Sykes's description of *Cyprinus potail* from the Deccan was based on a specimen 10 inches in length and it is no wonder that he found the barbels absent. Heckel described his *Tylognathus porcellus* from Bombay and characterized it by the presence of barbels; he gives the length of his species as 7 inches. In view of our detailed observations as noted above, we are unable to recognise these two species as distinct merely on the character of the barbels and have accordingly relegated *T. porcellus* to the synonymy of *Labeo potail*.

¹ Hora, S. L., Misra, K. S. and Malik, G. M., *Rec. Ind. Mus.*, xli, pp. 263-279 (1939).

² Hora, S. L. and Misra, K. S., *Rec. Ind. Mus.*, xlii, pp. 166-171 (1940).

³ Hora, S. L. and Misra, K. S., *Journ. Bombay Nat. Hist. Soc.*, xlii, pp. 316, 317 (1941).

THE MEDICINAL MALLOWWORTS OF INDIA.

BY

J. F. CAIUS, S.J., F.L.S.

The MALVACEAE include 35 genera, and over 700 species distributed chiefly in the warmer regions of both hemispheres. They are essentially tropical, diminishing rapidly as they recede from the equator, and they are more numerous in the northern tropics and in America than in the Old World. All the members agree in containing mucilage freely, and in possessing no unwholesome properties. Some contain free acids, and are employed as refreshing drinks; others yield volatile oils, and are classed among stimulants. The seeds contain a fixed oil, and their testa is often woolly; the bark of many is very tenacious.

Among the products obtained by analysis may be mentioned:— (1) *mucilage*; (2) *furfural*; (3) *glucosidal pigments*—althacin, gossypetin, malvin—; (4) *glucosides*—gossypitrin, isoquercitrin, quercimeritrin—; (5) *nitrogenous substances*—B-asparagin, betaine, choline—; (6) *alkaloids*—ephedrine, pseudophedrine—.

The medicinal Mallowworts of the world belong to 17 genera: ABUTILON (tropical and subtropical regions); ALTHAEA (temperate regions); CIENFUEGOSIA (America, Africa, Australia); GOSSYPIUM (tropical and subtropical regions); HIBISCUS (tropical and subtropical regions); KYDIA (India); LAVATERA (Mediterranean, Australia, mid-Asia); MALACHRA (warm America, West Indies); MALVA (northern temperate regions); MALVASTRUM (America, South Africa); MALVA-VISCUS (warm America); NAPAEA (North America); PAVONIA (tropical and subtropical regions); SIDA (cosmopolitan); SPHÆRALCEA (Cape Colony, America); THESPESIA (warm regions); URENA (tropical and subtropical regions).

The medicinal Mallowworts of India are included in 11 genera: ABUTILON, ALTHAEA, GOSSYPIUM, HIBISCUS, KYDIA, MALACHRA, MALVA, MALVASTRUM, PAVONIA, SIDA, THESPESIA, URENA.

A. Herbs or shrubs. Ripe carpels separating from the axis. Styles as many as the carpels.

I. Ovule solitary, ascending.

a. Stigmas linear.

1. Bracteoles 6-9 ALTHAEA.

2. Bracteoles 3 MALVA.

b. Stigmas capitate MALVASTRUM.

II. Ovule solitary, pendulous.

Carpels convergent at the points or beaked. SIDA.

III. Ovules 2 or more.

Carpels with no false partition ... ABUTILON.

B. Styles or stigmatic branches twice as many as the carpels.

I. Carpels opposite the petals.

a. Carpels unarmed MALACHRA.

b. Carpels beset with spines URENA.

II. Carpels opposite the sepals PAVONIA.

C. Herbs or shrubs. Fruit capsular. Sepals leafy.

Staminal tube truncate or 5-toothed at the apex.

I. Stigmas spreading. Seeds reniform. Stamens numerous. Bracteoles 5 or more ... HIBISCUS.

II. Stigmas coherent in a club-shaped mass.

a. Bracteoles 3-5, small ... THESPESIA.

b. Bracteoles 3, large, cordate ... GOSSYPIUM.

D. Trees. Sepals leathery. Styles connate or free.

Fruit capsular or indehiscent. Leaves simple or lobed. Bracteoles 4-5 ... KYDIA.

ABUTILON.

The genus numbers 120 species, natives chiefly of the tropical and subtropical regions of both hemispheres.

The leaves of all the species contain a large quantity of mucilage. The roots are regarded as cooling, astringent, and tonic. The seeds are considered antidysenteric.

The following species are used medicinally in China—*A. Avicennae* Gaertn.—; in Indo-China—*A. Avicennae* Gaertn., *A. indicum* G. Don—; in Malaya and the Philippine Islands—*A. indicum* G. Don—; in Gold Coast—*A. asiaticum* G. Don, *A. mauritianum* Sweet—; in La Reunion—*A. exstipulare* G. Don, *A. glaucum* Sw., *A. hirtum* G. Don, *A. indicum* G. Don—; in Somaliland—*A. glaucum* Sw.—.

Carpels more than 10, usually 15-20.

A. Carpels pointed or with a distinct mucro.

Carpels 8-13 mm. long.

a. Carpels hairy, ultimately glabrate, shining ... *A. indicum*.

b. Carpels densely hairy, ultimately shaggy ... *A. asiaticum*.

B. Carpels obtuse without a mucro.

I. Corolla 5 cm. diam.

a. Fruit globose, densely silky villous ... *A. glaucum*.

b. Fruit roughly hairy ... *A. hirtum*.

II. Petals hardly exceeding the sepals ... *A. Theophrasti*.

1. **Abutilon asiaticum** G. Don occurs in the Western Peninsula and in Ceylon. It is scattered over the tropics of both hemispheres.

In Gold Coast an infusion of the leaves macerated in water along with spices is drunk for venereal troubles.

In Southern Nigeria the juice of the plant is applied as an emollient to relieve soreness of the nates in young children.

Arabic: Hambok, Hanbuk—; *Bengal*: Petari—; *Ewe*: Kusiti—; *Fanti*: Nwarha—; *Ga*: Fufuba-tsho—; *Hindi*: Jhampi, Kangahi, Kanghi—; *Krepi*: Didinglome—; *Kuka*: Mulu—; *Marathi*: Chakrabhenda, Kangori, Petari—; *Sanskrit*: Balbija, Kalikanghi—; *Sinhalese*: Anoda—; *Songhai*: Talca-ouragna—; *Tamil*: Perundutti, Tutti—; *Telugu*: Botlabenda, Nugubenda, Peddabenda, Tutturubenda—; *Twi*: Apongo, Mmofra forowa—; *Uriya*: Jhonkapedi—.

2. **Abutilon glaucum** Sw. is fairly common in India and Ceylon. It extends to Afghanistan, the Mediterranean region, Arabia, Egypt, tropical Africa, the Cape, and Australia.

At Nasirabad the mucilaginous leaves are considered as a cure for piles. In La Reunion they are used as a pectoral.

Kachhi: Gidarwar, Tutare—; *Las Bela*: Bur—; *Nasirabad*: Giddarwal—; *Somali*: Balambal morodi—; *Swahili*: Balambal morodi—.

3. **Abutilon hirtum** G. Don occurs in the United Provinces and the Central Provinces, whence it spreads to South India and Ceylon; in Sind and Baluchistan, extending to Arabia and tropical Africa. It is distributed to Malaya and Australia.

The roots, leaves, and seeds are medicinal, and good substitutes for those of *A. indicum*.

Bengal: Barkhanghi—; *Cawnpore*: Barabanghi, Barkhanghi—; *Hindi*: Barkhanghi—; *Sunderbuns*: Bara kanghi, Bar potari—; *Tamil*: Vadattutti—; *Telugu*: Belabenda—; *Uriya*: Karpuripotro—.

4. **Abutilon indicum** Sw. is found throughout the tropics.

A decoction of the bark, leaves, and seeds together has been long used by the Hindus on account of its mucilaginous and diuretic properties.

Boiled milk, whisked with the fibrous twigs, coagulates; the fluid obtained by decantation is regarded by hakims as efficacious in hoemorrhoids when given internally.

The infusion of the root is prescribed in fevers as a cooling medicine, and is considered useful in strangury, haematuria, as also in leprosy.

The bark is valued as a diuretic.

The leaves are cooked and eaten in bleeding piles. A decoction is used in bronchitis, in catarrhal bilious diarrhoea, in gonorrhoea and inflammation of the bladder, and in fevers; it is prescribed as a mouth-wash in cases of tooth-ache and tender gums.

The root and leaves boiled with raisins and strained, make a pleasant diluent and demulcent.

The seeds are reckoned aphrodisiac, and are used as a laxative in piles, and in the treatment of coughs. They are burned on charcoal and the rectum of children affected with thread-worms is exposed to the smoke. Infused in hot water they form a cooling drink.

According to the Chinese in Hong-Kong, the seeds are employed as an emollient and demulcent; the root is used as a diuretic and pulmonary sedative, and the flowers and leaves as a local application to boils and ulcers. Porter Smith states that the seeds and the entire plant are used as 'demulcent, lenitive, diuretic, laxative and discutient remedies. Puerperal diseases, urinary disorders, chronic dysentery and fevers are treated with the seeds'.

The slightly bitter bark is considered diuretic in the Philippines. The root, leaves, and flowers are used as an emollient.

Arabic: Deishar, Masht-ul-ghola, Masht-ul-ghoul—; *Bengal*: Potari—; *Bombay*: Chakrabenda, Etari, Kangoi, Kangori, Pamaolni—; *Brahui*: Baibaro, Gogharo—; *Burma*: Bonkhoe, Bonkhoye, Thanurchok—; *Canarese*: Gidutingi, Hettukisu, Hettutti, Kisangi, Srimudre, Srimudrigida, Tutti—; *Chinese*: Kuan Sha Yuan—; *Cutch*: Balbij—; *Deccan*: Chakrabenda, Etari, Kangoi, Kangori, Pamudni—; *Goa*: Petari, Tupkadi—; *Guam*: Malbas, Malva, Matbas—; *Gujerati*: Dabali, Kantaki—; *Hindi*: Jhampi, Kandhi, Kanghani, Kanghi, Potari, Tepari, Tutri—; *Hongkong*: Tung K'uci—; *Ilocano*: Lulupao—; *Indo-China*: Coi xay, Dok tok lai—; *Kharwar*: Kakhi—; *Konkani*: Voddlipettari—; *Malaya*:

Kwan sa yin—; *Malayalam*: Katturam, Katturan, Pitik-kapattu, Tutti, Tuvatti, Uram, Velluram—; *Marathi*: Akakai, Kansuli, Karandi, Madmi, Mudra, Mudrika, Pidari, Vikankati—; *Mauritius*: Mauve du pays—; *Mundari*: Pusi-katadaru—; *Niger*: Abeokuta—; *Persian*: Darakhteshanah, Darakhteshane—; *Philippines*: Malvas, Malvas de Castilla, Tabing—; *Porebunder*: Bapat—; *Portuguese*: Fruta gargontilha, Malwa—; *Punjab*: Pilibuti, Sanbal—; *Rajputana*: Dabi, Jhili, Tarakanchi—; *Sanskrit*: Atibala, Balika, Balya, Bhuribala, Ghanta, Kankati, Rishiprokta, Shita, Shitapushpa, Vikankata, Vatyapushpika, Vrishyagandha, Vrishyagandhika—; *Santal*: Mirubaha—; *Siamese*: Klorb tabart—; *Sind*: Khapato, Pilibuti, Sunbul—; *Sinhalese*: Anodagaha—; *Sunderbuns*: Kanghi, Potari—; *Tagalog*: Cuacuacohan, Giliggiligan, Guilingguilingan, Melbas—; *Tamil*: Nallatutti, Paniyarattutti, Perundutti, Tutti—; *Telugu*: Adavibenda, Botlabenda, Dudi, Muttavashirubenda, Nugubenda, Peddabenda, Tutirichettu, Tutti, Tutturubenda—; *Tulu*: Urki—; *Twi*: Mmofoforowa—; *Urdu*: Kanghi—; *Uriya*: Nakochono—; *Visayan*: Dulupang, Malis, Pilis, Taratacopes, Yampong—.

5. *Abutilon Theophrasti* Medic. (= *A. Avicennae* Gaertn.) occurs in North-Western India, Sind, Kashmir and Bengal. It extends to Arabia, Egypt, the Mediterranean, and South-Eastern Europe. It is naturalized in many parts of Asia, Africa and America.

The leaves, seeds, and roots are put to the same uses as those of *A. indicum*.

In Indo-China a decoction of the seed is given in dysentery, fistulæ, and eye sores.

Chinese: Ch'ing Ma—; *English*: American Jute, Indian Mallow—; *French*: Jute de Chine—; *Indo China*: Manh ma—; *Meskwaki*: Menakwusk—.

ALTHAEA.

The genus consists of about 30 species, natives of the temperate regions of the Old World, and rarely found in the tropics.

This genus is well-known for the emollient and resolvent properties of its members.

The following are commonly used medicinally in Europe—*A. cannabina* Linn., *A. hirsuta* Linn., *A. officinalis* Linn., *A. pallida* Waldst. u. Kit., *A. rosea* Cav.—in China and Indo-China—*A. rosea* Cav.—.

- | | | |
|--|-----|-------------------------|
| 1. Stem 15-30 cm. high. Flowers 13-20 mm. diam | ... | <i>A. Ludwigii</i> . |
| 2. Stem 60-90 cm. Flowers 2.5-5 cm. diam. | ... | <i>A. officinalis</i> . |
| 3. Stem often exceeds 1.8 m. in height. | | |
| Corolla often exceeds 10 cm. across | ... | <i>A. rosea</i> . |

1. ***Althaea Ludwigii* Linn.** occurs in Agra, Bundelkhand, the Punjab, Sind, Baluchistan, and the Deccan. It extends to the Mediterranean, and South Africa.

In Wad the plant is used as an aperient, being for the purpose pounded and mixed with sugar and water, and strained.

Arabic: Ketmi, Khutmi—; *Baluchi*: Baharo—; *Brahui*: Utper—; *Kech*: Gwaragpad—; *Kohlu*: Gardaibutai, Girdaebutae—; *Panjgur*: Nampacho, Pochako—; *Wad*: Pachko—; *Waziristan*: Nagamboti—.

2. ***Althaea officinalis* Linn.** is found in Kashmir. It is distributed over the Mediterranean region and Central Europe as far as Siberia.

The great demulcent and emollient properties of Marsh Mallow make it useful in inflammation and irritation of the alimentary canal, and of the urinary and respiratory organs.

Decoctions of the plant, especially of the root, are very useful where the natural mucus has been abraded from the coats of the intestines. They are excellent in painful complaints of the urinary organs, exerting a relaxing effect upon the passages, as well as acting curatively. They are also effective in curing bruises, sprains or any ache in the muscles or sinews.

The powdered root boiled in milk is useful in haemorrhage from the urinary organs, and in dysentery. The powdered or crushed fresh roots make a good poultice that will remove the most obstinate inflammation and prevent mortification; they have proved more serviceable than the ointment albeit its popular reputation.

Boiled in wine or milk, Marsh Mallow will relieve diseases of the chest, constituting a popular remedy for coughs, bronchitis, whooping-cough, etc., generally in combination with other remedies. It is frequently given in the form of a syrup, which is best adapted to infants and children.

The fresh leaves, steeped in hot water and applied to the affected parts as poultices also reduce inflammation, and bruised and rubbed upon any place stung by wasps or bees take away the pain, inflammation and swelling.

In France, the young tops and tender leaves are added to salads, as stimulating the kidneys healthily.

The flowers, boiled in oil and water, with a little honey and alum, have proved good as a gargle for sore throats.

Arabic: Bazarulkhatme, Khetmia, Kobbeiza, Medja-el-Abiod, Moudjdjir, Ouerd-ez-zoual—; *Berber*: Amejjir, Binesar, Tebencert—; *Bombay*: Gulkhairo, Khaira, Khairakajhor, Khitmi, Khitmikajhor—; *Catalan*: Malvi, Malvins—; *Chinese*: Fou Ioung—; *Cutch*: Gulkhair—; *Danish*: Altaea, Ibisk—; *Deccan*: Gulkhairo, Khaira, Khairakajhor, Khitmikajar—; *Devonshire*: Drunkards, Meshmellish—; *Dutch*: Heemst—; *English*: Bread and Cheese, Bulls-eyes, Marsh Mallow, White Mallow, Wymote—; *French*: Althée, Althée officinale, Guimauve, Mauve blanche—; *Friuli*: Altee—; *Genoa*: Artea, Arteja, Marvaviscu, Marvaveste—; *German*: Adewurzel, Attigkraut, Eibisch, Fliesskrautwurzel, Flusskrautblume, Gilfwurz, Gimorwurzel, Guimauvewurzel, Heiligkraut, Heilwurz, Heilwurzelblume, Heinisch, Hemisch, Hemstwurzel, Henest, Hibisch, Hilfskraut, Hilfswurzel, Hustewurzel, Ibsch, Ibschpappel, Ibsche, Ivisch, Kinderbettee, Wilde Malvenwurzel, Weisse Pappel, Sammtpappel, Schleimwurzel, Stockwurzelkraut, Weisse Suessholzwurzel, Wollkraut—; *Greek*: Altea, Ibisco—; *Gujerat*: Gulkhair, Khaira—; *Hindi*: Gulkhairo, Khaira, Khairakajhor, Khitmikajhar—; *Hungarian*: Fejer Malval, Ziliz—; *Italian*: Altea, Avisch, Bismalva, Benefischi, Buonvischio, Davisch, Malvaccioni, Malvavischio, Malvischio, Marvaviscu—; *Languedoc*: Maoula blanca—; *Madagascar*: Fiandrilavenombazaha—; *Malta*: Marsh Mallow, Altea, Malvaccioni—; *Marathi*: Khaira, Gulkhair—; *Norway*: Altaea—; *Persian*: Gulkhairo, Jukhamekhatme, Khaira, Khairakajhor, Khitmi, Khitmikajhar—; *Portuguese*: Malvavisco—; *Reggio*: Bonaves'c—; *Romagna*: Maibon—; *Roumanian*: Nalba mare, Zamosita—; *Russian*: Altei, Dikaya roja, Podswonok, Proskurniak, Prosvirniak—; *Sardinia*: Narbaonia, Pramacisca, Rosa d' Ispagna—; *Somerset*: Bull Flower, Pool Flower—; *Spanish*: Altea, Hierba cañamera, Malvavisco—; *Swedish*: Altea—; *Tamil*: Simaitutti—; *Turkish*: Hatmi—; *Tuscany*: Erba que fa pisciar i buoi, Ibisco—; *Urdu*: Khatme, Khitmi—; *Venice*: Malvaviscio—.

3. **Althaea rosea** Cav., a native of Crete and Greece, is found planted in Indian gardens.

The seeds of this plant are demulcent, diuretic and febrifuge. The flowers have cooling and diuretic properties. The roots are supposed to be astringent and demulcent, and are much used in France to form demulcent drinks.

In the Punjab, the flowers are given in rheumatism, and the root in dysentery (Stewart).

The leaves and roots are also used for the same purposes as those of *A. officinalis*.

Bogotá: Malvarrosa—; *Catalan*: Malva doble, Malva vera—; *Chinese*: Shu K'uei—; *Dutch*: Stokroos—; *English*: Althea Rose, Hock Herb, Hollyhock, Round Dock—; *French*: Alcée, Alcée rose, Althée, Althée rose, Bâton de Saint-Jacques, Bourdon de Saint-Jacques, Guimauve rose-trémière, Mauve arborée, Mauve des jardins, Mauve rose, Passe-rose, Rose alcée, Rose à bâton, Rose de mer, Rose d'outre-mer, Rose papale, Rose trémière, Rose trénière—; *German*: Augenpappel, Baummalve, Baumrose, Brandrose, Braunrose, Erdntrose, Ehrénrose, Felriss, Feuerbluete, Gartenmalve, Glockenpappel, Glockrose, Halsrose, Herbströse, Herzleuchte, Hochleuchte, Kohlrose, Roemische Malve, Mundrose, Nackrose, Rosenpappel, Schwarzmalve, Siegmarsblume, Stangenrose, Stockmalve, Stockpappelrose, Stock-rose, Ungerblume, Weinrose, Wetterrose, Winterrose—; *Greek*: Altaia, Malachi rodoides—; *Hindi*: Gulkhairu, Gulkhirri—; *Indo-China*: Thuc guy—; *Iraq*: Ward-al-khathmi—; *Italian*: Malvarosa, Malvoni—; *Kurdish*: Gul hailu—; *Malta*: Hollyhock, Malvarosa, Malvoni, Rosoni, Bastun ta San Guisepp—; *Punjabi*: Gul khaira—; *Roumanian*: Nalba de gradina—; *Russian*: Chernaya rosa, Shtok-rosa—; *Spanish*: Malva arborea, Malva Doncella, Malva Isabela, Malva de los jardines, Malva loca, Malva del principe, Malva real, Malva de la reina, Malvarosa—.

GOSSYPIMUM.

The genus consists of 12 tropical and subtropical species.

The following are used medicinally in the Philippine Islands—*G. arboreum* Linn., *G. barbadense* Linn., *G. herbaceum* Linn., *G. perenne* Linn.—; in Cochinchina and China—*G. herbaceum* Linn.—; in North America—*G. barbadense* Linn., *G. herbaceum* Linn., *G. hirsutum* Linn.—; in Porto Rico—*G. racemosum* Poir.—; in Peru—*G. peruvianum* Cav.—; in Brazil—*G. barbadense* Linn.—; in Guinea—*G. barbadense* Linn., *G. herbaceum* Linn.—; in Guinea—*G. hirsutum* Linn.—.

A. Flowers wholly yellow or yellow with purple base.

Involucral bracts laciniate.

I. Cotton adherent to the seeds.

a. Seeds with underlying down ... *G. herbaceum*.

b. Seeds with firmly adherent downy down underlying cotton of the same colour or white ... *G. hirsutum*.

II. Cotton easily separable from the seeds ... *G. barbadense*.

B. Flowers wholly purple or yellow with purple base.

Involucral bracts subentire or toothed, not laciniate *G. arboreum*.

1. *Gossypium arboreum* Linn. is grown in gardens and about temples.

In Bombay, the root is used in the treatment of fever.

In the Konkan, the root, rubbed to a paste with the juice of patchouli leaves, has a reputation as a promoter of granulation in wounds; and the juice of the leaves, made into a paste with the seeds of *Vernonia anthelmintica*, is applied to eruptions of the

skin following fever. In Pudukota, the leaves ground and mixed with milk, are given for strangury.

The petals squeezed and soaked in human or cow's milk, are used as a soothing and effective application for conjunctivitis of infants.

The cotton is a very useful external remedy in burns, scalds, and some other surgical diseases. The seeds exercise some good influence over gonorrhoea, gleet, chronic cystitis, consumption and some catarrhal affections. The fresh young capsules and shoots have been observed to produce good effects in some cases of dysentery and gonorrhoea. The control of the seeds over gonorrhoea and gleet is more manifest when combined with some other drugs.

In Southern India an emulsion of the seeds is used as an antidote for opium poisoning, and in general for poisoning with narcotics; a decoction of the root is said to be emollient and diuretic.

In Tropical West Africa the leaves, flowers and seeds are used medicinally. A cold infusion of the leaves in water with lime juice has been found to give relief in dysentery. The root is believed to be emmenagogue with an action like that of ergot. As the use of the root to procure abortion is known amongst American negroes, but not in the Orient, the knowledge of this property appears to be indigenous to Africa. The active principle resides in the root-bark. The leaves and crushed seed-kernels are applied to sores or as a poultice to bruises and swellings, and the lint as a dressing to wounds. A paste of the seeds is applied to the forehead and temples for headache.

Barranguilla: Algodón pajarito—; *Bombay*: Deokapas—; *Bundelkhand*: Boojali, Nurma—; *Burma*: Nuwa—; *Canarese*: Anji, Hanji, Kari arale, Karihatti—; *Central Provinces*: Deo, Mannua—; *Dacca*: Borailly—; *Egypt*: Gotn—; *English*: Tree Cotton—; *French*: Cotonnier arborescent—; *Guam*: Algodon—; *Hausa*: Abduga, Auduga—; *Hindi*: Deokapas, Nurma—; *Malayalam*: Chemparutti—; *Marathi*: Devakapusa—; *Mysore*: Deokurpas—; *North-Western Provinces*: Manua, Nurma, Radhia—; *Pondicherry*: Cotonnier—; *Punjab*: Kapas—; *Sanskrit*: Karpasamu—; *Santal*: Bhogakuskum, Budikas-kom—; *Sokoto*: Kada—; *Spanish*: Algodonero, Algodonero arboreo—; *Tagalog*: Bulacnabundoc, Bulacnatotoo—; *Tamil*: Sembarutti—; *Telugu*: Patti—; *Visayan*: Bulacngabisaya—; *Yemen*: Odjaz, Oth, Zejt.

2. *Gossypium barbadense* Linn. is cultivated in India.

The seeds, in the form of an emulsion, are given in dysentery and are supposed to be pectoral. They yield by expression an oil which is much used to clear the skin of spots and freckles.

A tea made of the young leaves is recommended in lax habits, and for preparing a vapour bath for the anus in cases of tenesmus.

Arabic: Lekid—; *Betsimisarak*: Hasina, Landihazo—; *Canarese*: Karihatti, Vilayatihatti—; *Egypt*: Ashmuny, Gotn, Gotn-esh-sheger—; *English*: Sea-island Cotton—; *Gambia*: Dulóboro—; *Guam*: Algodon—; *La Reunion*: Gros coton—; *Malayalam*: Chemparutti—; *Philippines*: Bulac Fernambuco, Bulac Pernambuco, Canton, Pernambuco—; *Sanskrit*: Maghani, Purvam—; *Tamil*: Arattam, Mayiliyam, Sembanja, Sembarutti, Simaipparutti—; *Tahiti*: Vavai—; *Telugu*: Ettappatti, Paidipatti, Pamidipatti—; *Uriya*: Rongokopa—; *Uruguay*: Algodonero—.

3. *Gossypium herbaceum* Linn., probably indigenous in Northern Arabia and Asia Minor, is found cultivated in the North-Western

Frontier Province and Baluchistan. It is also met with in Afghanistan, Persia, Mesopotamia, Syria, Egypt, the Mediterranean region, and the United States of America.

A hip bath of the young leaves and roots is recommended in uterine colic. The Tamil doctors prescribe a decoction of the root in strangury and gravel.

The juice of the leaves is considered a good remedy in dysentery, and the leaves with oil are applied as a plaster to gouty joints.

A syrup of the flowers is prescribed in cases of morbid depression on account of its stimulating and exhilarant effect; a poultice of them is applied to burns and scalds.

The seeds are used as a laxative, expectorant, and aphrodisiac. Pounded cotton seed, mixed with ginger and water, is applied in orchitis.

Cotton is used as a moxa. Burnt cotton is applied to sores and wounds to promote healthy granulation.

In Cambodia every part of the plant is used medicinally. The whole plant is considered febrifuge; the flowers and leaves are said to be pectoral and sudorific.

In Annam the flowers are given in amenorrhoea and dysmenorrhoea; the oil from the seeds is applied to wounds, and used in scabies and herpes.

In North America the root bark is used in large doses as an abortifacient. The seeds are considered antidysenteric and galactagogue. The juice of the leaves is administered as an emollient in diarrhoea and in mild forms of dysentery.

In South America cotton-seeds in the form of decoction are employed in the treatment of intermittent fevers.

In India the juice of the fresh leaves is considered very efficacious in the treatment of snake-bite, and the root and leaves are recommended for the treatment of scorpion-sting. But Caius and Mhaskar have shown experimentally that the leaves are not an antidote to snake venom, and that neither the root nor the leaves have any effect in the symptomatic treatment of scorpion-sting.

Annam: Bong se, Bong tau, Cat boi, Cay bong, Cay bong lam vai, Cay vai bong, Thao Khoang—; *Arabic*: Fitan. Kotonefezzani. Kurtamussul—; *Bengal*: Kapas, Tula—; *Bombay*: Kapas, Rui—; *Bulandshahr*: Binaula—; *Burma*: Wa, Wah—; *Cambodia*: Krabas—; *Canarese*: Ambara, Arale, Arali, Badari, Dudi, Hatti, Kariharivale, Karpasa, Tula—; *Central Provinces*: Kapas—; *Deccan*: Kapas—; *Egypt*: Gotn, Gotn-el-sadjar—; *English*: Common Cotton, Indian Cotton—; *French*: Cotonnier, Cotonnier herbacé, Cotonnier de Malte—; *Greek*: Bombaki—; *Gujerati*: Kapas, Ru—; *Hindi*: Deokapas, Kupas, Narma, Rui—; *Indo-China*: Bong, Fai, Krabas, Mien hoa, Thao mien—; *Irao*: Outn¹, iraqi—; *Konkani*: Kapsini, Kapus—; *Malayalam*: Badara, Karppas, Karppasi, Karuparutti, Kuruparatti, Pangni, Paritti, Parutti, Pishu, Tulam, Tundikeri—; *Malta*: Common Cotton, Indian Cotton, Short stapled Cotton, Cotone, Koton Malti, Koton ta Malta—; *Marathi*: Kapus, Ru—; *Mundari*: Kadsom, Kaksom, Karsom, Kaskom, Kasom, Katsom—; *Pampangan*: Balac Castila—; *Persian*: Pambah—; *Portuguese*: Algoda, Algodoeiro—; *Punjab*: Broach Kapa, Rui—; *Rajputana*: Kapas—; *Roumanian*: Bumbac—; *Russian*: Khlochatnik—; *Sokalave*: Tsiabilika—; *Sanskrit*: Anagnika, Badara, Chavya, Chhadana, Guda, Kalakanta, Karpasasarini, Karpasi, Maghani, Marudbhava, Patada, Patahena, Pichu, Samudranta, Sutrapushpa, Tula, Tundakerika, Tundikeri, Vadara—; *Sind*: Vaum—; *Sinhalese*: Kapus—; *Spanish*: Algodonero—; *Tavalog*: Bulac, Bulag—; *Tamil*: Iladambarutti, Karbasam, Karppasam, Panji, Pari, Parutti, Samuttrandam, Taiparutti, Tulam, Tulavam, Uppambarutti, Uttiri, Vanap-

parutti—; *Telugu*: Badari, Badarika, Edudi, Karpasamu, Patti, Pinja, Pishulamu, Pishuvu, Pratti—; *Tuareg*: Tabdouk—; *Tulu*: Parti—; *Uraon*: Rabji—; *Uriya*: Karpaso, Kopa, Korpaso—; *Urdu*: Rui—; *Visayan*: Cadaba, Candaba, Gapas—.

4. **Gossypium hirsutum** Linn. is found cultivated in India.

In Guinea the seeds and the leaves are considered emollient, the roots emmenagogue.

Fulani: Hotollo—; *Malinke*: Koroni—; *Malta*: Koton ta Gallipoli—; *Punjabi*: Safed narma—; *Sinaloa*: Algodon—; *Soussou*: Guessefente—; *Zambesi*: Tonje-manga—.

HIBISCUS.

The genus numbers 160 tropical and subtropical species.

The roots are much used as demulcent. The seeds are considered stimulant and antispasmodic.

The following are used medicinally in Europe—*H. esculentus* Linn., *H. rosa-sinensis* Linn., *H. syriacus* Linn., *H. Trionum* Linn.—; in Egypt—*H. Abelmoschus* Linn., *H. syriacus* Linn.—; in Tropical West Africa—*H. Abelmoschus* Linn., *H. asper* Hook. f., *H. cannabinus* Linn., *H. esculentus* Linn., *H. rostellatus* Guill & Perr., *H. Sabdariffa* Linn., *H. tiliaceus* Linn., *H. vitifolius* Linn.—; in South Africa—*H. aethiopicus* Linn., *H. leiospermus* Haw., *H. malacospermus* E. Mey., *H. pusillus* Thunb., *H. Trionum* Linn., *H. surattensis* Linn.—; in East Africa—*H. Sabdariffa* Linn.—; in La Reunion—*H. esculentus* Linn., *H. liliiflorus* Cav., *H. rosa-sinensis* Linn., *H. Sabdariffa* Linn.—; in Madagascar—*H. diversifolius* Jacq., *H. phanerandrus* Baker, *H. tiliaceus* Linn.—; in Mauritius—*H. esculentus* Linn., *H. liliiflorus* Cav., *H. mutabilis* Linn., *H. rosa-sinensis* Linn., *H. tiliaceus* Linn.—; in the Philippine Islands—*H. Abelmoschus* Linn., *H. grewiaefolius* Hassk., *H. Lampas* Cav., *H. mutabilis* Linn., *H. rosa-sinensis* Linn., *H. surattensis* Linn., *H. tiliaceus* Linn.—; in Malaya—*H. mutabilis* Linn., *H. rosa-sinensis* Linn., *H. syriacus* Linn., *H. tiliaceus* Linn., *H. Trionum* Linn.—; in Indo-China—*H. Abelmoschus* Linn., *H. Manihot* Linn., *H. mutabilis* Linn., *H. rosa-sinensis* Linn., *H. syriacus* Linn., *H. tiliaceus* Linn., *H. Trionum* Linn.—; in China—*H. Manihot* Linn., *H. mutabilis* Linn., *H. rosa-sinensis* Linn., *H. syriacus* Linn.—; in the West Indies and South America—*H. Abelmoschus* Linn.—; in Guiana—*H. Abelmoschus* Linn., *H. digitiformis* DC., *H. esculentus* Linn., *H. mutabilis* Linn., *H. Sabdariffa* Linn., *H. tiliaceus* Linn.—; in Tahiti—*H. rosa-sinensis* Linn.—; in North America—*H. californicus* Kell., *H. esculentus* Linn., *H. rosa-sinensis* Linn.

A. Style distinctly lobed. Involucre not caducous.

Calyx terminated by 5 distinct lobes. Capsule woody, dehiscient, many-seeded *H. Lampas*.

B. Capsule 5-celled

I. Calyx membranous, inflated *H. Trionum*.

II. Calyx not inflated

a. Involucral bracts distinct, 8-12, forked or provided with a leafy appendage

1. Stipules semicordate, auricled *H. surattensis*,
2. Stipules lanceolate *H. furcatus*.

- b. Involucral bracts without appendages. Seeds cottony.
Leaves broad, ovate, not lobed *H. micranthus*.
- c. Involucral bracts without appendages, sometimes adnate to the calyx-tube. Seeds smooth or hairy, not cottony.
 - 1. Capsule 5-winged. Seeds tubercled *H. vitifolius*.
 - 2. Capsule not winged. Seeds nearly glabrous or smooth.
 - a. Sepals with a gland at the back of each *H. cannabinus*.
 - β. Sepals not glandular *H. diversifolius*.
- d. Involucral bracts adnate to the calyx-tube, accrescent, thick, fleshy, purple *H. Sabdariffa*.
- e. Involucral bracts 4, distinct *H. Manihot*.
- f. Involucral bracts more than 5, linear.
 - 1. Involucral bracts shorter than the calyx *H. Abelmoschus*.
 - 2. Involucral bracts equalling the calyx *H. esculentus*.
- C. Capsule with false dissepiments, spuriously 10-celled.
Involucral bracts connate at the base. A tree *H. tiliaceus*.
- D. Cultivated species.
 - I. Corolla 7.5 cm. diam. red *H. rosa-sinensis*.
 - II. Corolla 7.5-10 cm. diam. white or pink *H. mutabilis*.

1. **Hibiscus Abelmoschus** Linn. is found in cultivation throughout the hotter parts of India. It is met with in most other tropical countries.

Ayurveda and Yunani practitioners recognize the seeds as cold, dry, tonic and stomachic. The latter recommend a mucilage made from the root and leaves in gonorrhoea.

The natives of Western Africa use the leaves as an emollient in inflammations of the eyes, and the pounded seeds as a stomachic and digestive tonic.

Antsianaka: Sondrranajaza—; *Arabic*: Habb-ul-mishk, Habb-ul-mushk—; *Bambura*: Suma-diala—; *Bengal*: Mushakdana—; *Betsimisarak*: Mana—; *Bombay*: Mishkdana, Mushkdana—; *Brazil*: Guicombo, Guigombo do cheiro—; *Burma*: Baluwa—; *Canarese*: Kasturibende—; *Ceylon*: Vattilaikasturi—; *Colombia*: Abelmusco, Almizclillo, Majaguito de playa—; *Deccan*: Kasturibenda, Kasturubenda, Mushkbenda—; *English*: Musk Mallow—; *French*: Abelmosc, Ambrette, Gombo musqué, Graine de musc, Guimauve veloutée, Ketnie odorante—; *French Guiana*: Ambrette, Calalou musqué—; *German*: Ambre, Ambrette, Bisorn—; *Gold Coast*: Osamankroma, Saman nkuruma—; *Gujerati*: Mushakdana—; *Hindi*: Kalakasturi, Mushkaana—; *Indo-China*: Bong trang nui, Bong vang, Nhan sam, Vong vang—; *Italian*: Ambretta—; *Malay*: Kapas hantu, Kapas hutan—; *Malayalam*: Kasturiventa, Kattukasturi—; *Marathi*: Kasturibhenda—; *Mende*: Feo-bonde, Grabondo, Musukui—; *New Caledonia*: Adlivigona-gahako—; *Pampangan*: Castocastolian—; *Persian*: Mushkdana—; *Roumanian*: Pesma—; *Russian*: Dushishtayan ketmia, Mukush-naya trava—; *Sakalave*: Tsindraranajaza—; *Sanskrit*: Latakasturika—; *Sinhalese*: Kapukimissa, Kapuyinessa—; *Southern Nigeria*: Okolooiin-yelologo—; *Spanish*: Abelmusco, Ambarina—; *Susu*: Baminkame, Soumari—; *Tagalog*: Castio, Castiocastogan, Sastogan, Castoli, Dalupan, Putucan—; *Tamil*: Kasturivendia, Kattukasturi—; *Telugu*: Karpurabenda, Kasturibenda, Nela-benda—; *Tukulor*: Kundialana—; *Urdu*: Mushkadanah—; *Visayan*: Ducum, Marapoto, Maricum, Maropoto, Marucum—.

2. **Hibiscus cannabinus** Linn. is generally cultivated in most tropical countries.

The seeds are used as an external application to pains and bruises, and are said to be aphrodisiac and fattening.

One tola of the juice of the flowers, with sugar and black pepper is a popular remedy for biliousness with acidity.

The leaves are purgative. In Northern Nigeria they are powdered and used as a local application for Guinea-worm sores.

Arabic: Til—; *Australia*: Okra, Surm—; *Bakundu*: Belokaloke—; *Balondo*: Bolokoloko—; *Bambara*: Da dian, Da fou, Da ian, Da wulu—; *Basari*: Inangaé—; *Basrah*: Gunnab—; *Bauchi*: Jirin da rani—; *Behar*: Kudrum—; *Bengal*: Ambari, Chandana, Mestapat, Nalita, Nalki, Patsan, Pulu, Pulua—; *Bombay*: Ambari—; *Bozo*: Fo—; *Canavese*: Holadapundrike, Pundi—; *Central Provinces*: Ambari—; *Chanda*: Ambari—; *Chota Nagpur*: Kudrum—; *Dagomba*: Balaga—; *Delhi*: Tukhmibhang—; *Djenne*: Bargin—; *Egypt*: Til, Tylbeledy—; *English*: Ambari Hemp, Ambasi Hemp, Bastard Jute, Bimlipatam Jute, Bombay Hemp, Deccan Hemp, Hemp Bendy, Hemp-leaved Hibiscus, Indian Hemp—; *Ewe*: Abema, Egbepetri—; *French*: Chanvre de Guinée—; *Fulani*: Follere pa'bi, Baji, Gabai, Polle, Polli—; *Gambia*: Wild Saur—; *Gbari*: Sawung—; *Godavari*: Gaynara—; *Guierati*: Bhindiyamboi, Sheria—; *Hausa*: Farar rama, Jar rama, Rama—; *Hindi*: Ambari, Kudrum, Mestapat, Nalita, Nalki, Patsan, Pulu, Pulua, San, Sankarkra, Sankukra—; *Ibo*: Odu agu, Udo ocha—; *Iraq*: Jiljil—; *Jhelum*: Shan—; *Jukun*: Azhi—; *Kano*: Dirin da rani—; *Kanuri*: Ngabbai—; *Katsina*: Karamapnowa, Koka rani—; *Kolami*: Ji, Kotle—; *Konkomba*: Ditoanje, Ditotone—; *Kratchi*: Niaripari, Riaripari—; *La Reunion*: Chanvre de Gombo—; *Malayalam*: Kanjaru—; *Malinke*: Da le—; *Mandingo*: Da julo, Da sitto—; *Marathi*: Ambada, Ambadi, Khadbind, Khar bhendi—; *Martinique*: Chanvre de Gombo, Gombo—; *Mbonge*: Belokaloka—; *Mundari*: Kotole, Kotoleara, Kotoleipilara—; *North-Western Provinces*: Patsan, Pitava, Rattiasan—; *Persian*: Kanabe, Kanaff, Kanaspe, Sujjado—; *Punjab*: Patsan, Sankokla, Sankokra, Sankukri, Sinjubara—; *Rajputana*: Ambari—; *Sanskrit*: Amla, Ambalika, Ambashtha, Ambika, Balika, Bhurimalli, Chhinnapatri, Chitrapushpi, Dridhvalka, Gandhapatri, Garnikura, Keshi, Machika, Marvurika, Mavurvidala, Mukhavachika, Nali, Phalamla, Prashthika, Rajjudambashtha, Sahasravatamulika, Shathamba, Shreyasi—; *Santal*: Darekudrum, Kudrung—; *Sind*: Sujjado—; *Sokoto*: Kare niki, Karama mowa—; *Songhai*: Koro guisouma—; *South Africa*: Wild Stock Rose—; *Susu*: Forto bamingui—; *Tamil*: Kachurai, Palungu, Pulichai, Pulicharkirai, Pulimanai—; *Telugu*: Gogu, Gongura, Gonkura, Gulungu, Pundikura—; *Tschaudjo*: Rama—; *Tukulor*: Polle ngagina—; *Twi*: Ishoho, Ishoho vesen—; *Uran*: Kudrundora, Tape—; *Uriya*: Bhanga, Kanuriya, Kornniya—; *Wolof*: Pondori—; *Yoruba*: Ida orisha, Oja ikoko, Yemoro, Yewuru—.

3. **Hibiscus diversifolius** Jacq. occurs in Burma. It is distributed over tropical Africa and Australia.

Every part of the plant is used as an emollient in Madagascar.

The native physicians of Fiji use the juice of the leaves to procure abortion.

Betsileo: Tsotsona—; *Imerina*: Roibevavy—; *Madagascar*: Roibe—; *North Queensland*: Cooreenyan—.

4. **Hibiscus esculentus** Linn. is found cultivated throughout India and in all tropical countries.

The plant is a household medicine, and highly esteemed by both Hindu and Mahomedan practitioners as an emollient and demulcent. The leaves are used to form emollient poultices.

The mucilage from the fruits and seeds is useful in gonorrhoea and irritation of genito-urinary system.

The immature capsules are employed in the form of a decoction as an emollient, demulcent, and diuretic in catarrhal affections, ardor urinae, dysuria, and gonorrhoea.

In Guinea the fruit and the leaves are used as emollient. In some parts of West Africa mild aphrodisiac properties are attributed to the seeds.

In Guiana the plant is very much used as a cooling mucilage; every part of the plant is considered emollient and employed as such; the fruit boiled in milk is given for cough.

Arabic: Baeledi, Bami, Bamiya, Guenaouia, Uaeki—; *Ashanti*: Nkuruma—; *Bafo*: Ndando—; *Bakossi*: Ndando—; *Bakundu*: Mabune—; *Bakwiri*: Ndando—; *Balondo*: Mawuni—; *Balong*: Ndando—; *Bambara*: Gan, Guan, Guaniala—; *Banda*: M'Veke—; *Basari*: Imo—; *Batanga*: Mabune—; *Bengal*: Dhenras, Dhenrus, Dheras, Ramtorai—; *Benin*: Ikhiavbo—; *Bombay*: Bhenda, Chendi—; *Bota*: Ndando—; *Brazil*: Guiabo, Guingombo—; *Burma*: Younpadisi—; *Canarese*: Bendakainaru, Bendekai, Bhende—; *Central Provinces*: Bhendi—; *Ceylon*: Bandakkai—; *Cuba*: Quimbombo—; *Dagomba*: Mana, Manvale—; *Deccan*: Bhendi—; *Efik*: Etighi—; *Egypt*: Bamia, Belledi, Ueki—; *English*: Edible Hibiscus, Gobba, Gumbo, Lady's Fingers, Ochro, Okra—; *Ewe*: Petri—; *Fanti*: Nkuruma—; *Fra-Fra*: Marna—; *French*: Bamia, Gombault, Gombeau, Gombo, Kermie comestible, Mauve comestible, Okra—; *French Guiana*: Calalou, Calou—; *Ffulde*: Baskoje, Takkei—; *Fulani*: Candie, Takaere, Takeyi, Taku—; *Ga*: Engmomi—; *Gbari*: Okmi—; *Gujerati*: Bhinda, Bhindu, Binda—; *Gurunshi*: Paura—; *Hausa*: Guro, Ku 'baiwa, Ku 'bewa, Yau 'di—; *Hindi*: Bhendi, Bhindi, Bindi, Katavandai, Ramturai, Ranturi—; *Ibibio*: Etikhe—; *Ibo*: Okolo, Okuro, Okworo, Okwulu, Okwuru—; *Iraq*: Bamia—; *Kabura*: Mana—; *Kanuri*: Gebalgo, Gobasko, Gubaltu, Njita kimé—; *Kissi*: Gbasa—; *Kolami*: Mindjinga—; *Konkani*: Bendo—; *Konkomba*: Emoi—; *Konno*: Bondoi, Gbondui—; *Koranko*: Bonde—; *Krepi*: Alokoe, Atise, Bodro, Mesedi—; *Krobo*: Muomi, Pingpesi, Pui—; *La Reunion*: Lalo—; *Lepcha*: Hryok kun-tsu—; *Louisiana*: Gobbo, Gumbo—; *Losso*: Mana, Meni—; *Malayalam*: Vanta—; *Malinka*: Gavu, Gau, Guan—; *Mandingo*: Kainjo, Kanjo, Nah—; *Manja*: Gona, M'Beyi, Yoga—; *Mano*: 'Zambe—; *Marathi*: Bhenda, Bhendi—; *Mauritius*: Bhindi, Lalo, Ramtouraye, Vendekaye—; *Mbonge*: Mabuna—; *Mende*: Bonde, Bondebondogbamai, Bonde nande, Bonde valiangoi, Bondo—; *Mexico*: Chinbombo, Gombo, Quingombo—; *Mundari*: Mindidiring, Ramjhingga—; *Nupe*: Kpamfine, Kpanmi—; *Panama*: Naju—; *Peking*: Yang Chiao T'ou—; *Persian*: Bamiyah—; *Porto Rico*: Guingambo—; *Portuguese*: Quiabo—; *Portuguese Guinea*: Quingombo—; *Punjab*: Bhindatori, Bhindi, Bhinditori, Ramturai—; *Sanskrit*: Asrapatraka, Bhenda, Bhinda, Bhindatika, Chatupunda, Chatuspada, Darivka, Gandhamula, Karaparna, Kshatrasambhava, Pichchila, Sushaka, Tindisa, Vrittabija—; *Santal*: Ramjinga—; *Sarracole*: Diakatame—; *Shanghai*: Yang Koh Deu—; *Serere*: Kandia—; *Sherbro*: Lonto-le—; *Shuwa*: *Arabic*: Bamiya, Daraba gabesco, Daraba umm gurun—; *Sind*: Bhendi, Ramturai—; *Sinhalese*: Bandakai, Bandakka, Okra—; *Sobo*: Ishavbo—; *Sokoto*: Guro—; *Songhai*: Gombo, Karas, Lahoil—; *Spanish*: Guimbombo—; *Susu*: Sulegni, Sulinyi, Sulunyi—; *Tamil*: Vendai, Vendi—; *Telugu*: Benda, Penda, Venda—; *Timne*: A-lontho, E-lunto—; *Tivi*: Ityulugh—; *Tschaudio*: Gmana—; *Twi*: Nkuruma—; *Vai*: Gbongbong—; *West Africa*: Bendi kai, Ochro, Okra—; *West Indies*: Bendi kai, Common Okra, Gombeau, Gombo, Guiabo, Long Green Okra, Ochro, Okra—; *Wolof*: Kandia—; *Yemen*: Bamia—; *Yoruba*: Ila, Ilasa, Ilasado, Ilasha—.

5. **Hibiscus furcatus** Roxb. occurs in the hotter parts of India and Ceylon. It is distributed over the tropics of the Old World.

An infusion of the roots in water is a good cooling drink for the hot weather.

Canarese: Huligowri—; *Malayalam*: Naranampuli, Pachapuli, Suriyamani—; *Sinhalese*: Hinnapiritta, Napiritta—; *Telugu*: Kondagogu, Kondagongura—; *Uriya*: Piriipirika—.

6. **Hibiscus Lampas** Cav. occurs in the Himalaya up to 4,000 feet Bengal, Burma, Konkan, Kanara, the Western Ghats up to 3,000 feet,

the Northern Circars, Deccan and Ceylon. It extends to Java and Eastern tropical Africa.

The root and fruit are used in Chota Nagpur as a remedy in gonorrhoea and syphilis.

Assam: Bonkapash—; *Bengal*: Bankapas, Bankapsi, Bankapus—; *Canarese*: Adavibende, Turuve—; *Central Provinces*: Jangli bhendi—; *Dehra Dun*: Bankapasi—; *Gujerati*: Paruspiplo—; *Hindi*: Bankapas, Bankapasi, Kakhi, Kasyapal—; *Ho*: Reke—; *Kolami*: Birkatsom—; *Lepcha*: Ka-fal-muk—; *Malayalam*: Daraba, Kattuparatti—; *Marathi*: Janglibhenda, Ranbhendi—; *Matheran*: Lahanbhendi, Ranbhendi—; *Mundari*: Birkadsom, Birkaksom, Birkarsom, Birkaskom, Birkasom, Birkatsom—; *Pangasinan*: Banaro—; *Porebunder*: Adbauporushpiplo, Jangliparushpiplo—; *Rannagar*: Bankapasi—; *Santal*: Birkatsom, Bonkapsi—; *Tagalog*: Banagapula, Bannago—; *Telugu*: Adavibende, Adavipratti, Bharadvaji, Kondapatti, Pagadipatti, Pattinga—; *Uriya*: Bonokopa—; *Visayan*: Bannago, Bulacan—.

7. **Hibiscus Manihot** Linn. is found in Bengal, Mount Abu, Gujerat, Konkan, the Western Ghats, and along the West Coast from South Kanara to Travancore.

In Indo-China the bark is considered emmenagogue. It is used in the form of mucilage.

Chinese: Huang Shu K'uei, Shu Kuei—; *Ga*: Laga laga—; *Indo-China*: Hoang thuc quy—.

8. **Hibiscus micranthus** Linn. f. is found in the hotter parts of India from North-Western India eastwards and southwards to Ceylon. It spreads to Arabia and tropical Africa.

The plant is considered a valuable febrifuge in Ceylon.

Acur: Ligat atolo, Rigaget elo—; *Asmara*: Chercurantel—; *Baluchi*: Zwangir—; *Ceylon*: Perumaddi—; *Cutch*: Darianujhad, Kurudwel—; *Ga*: Lagalaga—; *Gujerati*: Chanakbhindo—; *Mensa*: Konatal—; *Porebunder*: Abaubuporio, Darianujhad—; *Tamil*: Sittamutti—; *Telugu*: Chalabharata, Tuturubenda—.

9. **Hibiscus mutabilis** Linn., indigenous in China, is cultivated in India.

In Malaya and China the flowers are an established remedy for pectoral and pulmonary complaints; they are prescribed as a stimulant. The leaves are applied to swellings.

In Guiana the plant is used as an emollient.

America: Confederate Rose, Cotton Rose—; *Bengal*: Sphalpadma, Thulpadma—; *Canarese*: Nelaolavare, Suryakanti—; *Chinese*: Fu Jung, Mu Fu Jung—; *Colombia*: Amistad del día, Rosa de engaño, Variedad—; *English*: Changeable Rose—; *French Guiana*: Caractère des dames, Rose changeante—; *Guam*: Mapola—; *Hindi*: Gul-i-ajab, Shalapara, Sthalkamal—; *Indo-China*: Moc phu dung, Phu dung—; *La Reunion*: Passe-rose—; *Malaya*: Foo yoon—; *Malayalam*: Chinapparatti, Hinaparutti—; *Mauritius*: Passe rose, Satoula padma—; *Mexico*: Amistad—; *Philippines*: Mapola—; *Porto Rico*: Maravilla—; *Portuguese*: Amor inconstante, Rosa mudavel—; *Punjab*: Gul i ajab—; *Sanskrit*: Padmacharini, Sthalpadma—; *Tamil*: Irattavellaichembarattam, Sembarattai—; *Uriya*: Sthalopidmo, Tholopodmo—; *Uruguay*: Farolito japonés, Flor de la vida, Rosa de mayo—.

10. **Hibiscus rosa-sinensis** Linn. is found cultivated in gardens throughout India,

The flowers are considered emollient, and an infusion of the petals is given as a demulcent. Fried in ghee they are administered for checking excessive menstruation. In La Reunion they are reputed to be emmenagogue.

The flowers are a household remedy in the Philippine Islands. Externally they are used in all kinds of inflammation; internally they are prescribed in the form of decoction in bronchial catarrh as a bechic and sudorific.

The root is mucilaginous and demulcent, valuable in coughs. In the Konkan the powdered root is used in menorrhagia, and the juice of the fresh root is given for gonorrhoea.

The bark is said to act as an emmenagogue.

The leaves are emollient and aperient. In China they are used in paralysis and dysmenorrhea.

Arabic: Angara-e-hindi—; *Bengal*: Jaba, Japa, Jiwa, Joba, Juwa, Oru, Patkili—; *Bombay*: Jasavanda—; *Burma*: Kaungyan, Koungyan—; *Canarese*: Dasanihu, Dasavala, Dasavana, Kempupundrika, Nadeya—; *Cantonese*: Ch 'uen Kan—; *Chinese*: Ch 'uan Chin, Fu Sang, Houng Hoa—; *Colombia*: Alsaciana, Astromelia, Cayena, Escandalosa, Isleña, Resucitado, Roja—; *Deccan*: Gudel, Jasum, Jasum, Jasut, Kudhal—; *English*: Scarlet Rose-mallow, Shoe Flower—; *French*: Kermie de Cochinchine, Rose de Chine—; *Guam*: Gumamela—; *Gujerati*: Jasuva—; *Hindi*: Jasum, Jasun, Jasut—; *Ilocano*: Cayanga—; *Indo-China*: Dam but, Dok mai, Hong can, Phu tang—; *Konkani*: Doxini—; *Malaya*: Choon kin—; *Malayalam*: Ayamparutti, Jampa, Japa, Shemparatti—; *Marathi*: Desindachaphula, Jasavanda, Jasavandi—; *Mauritius*: Djassoun, Foulsapate, Sapatoucheddi—; *Nasirabad*: Badshapashand—; *North America*: China Rose, Chinese Hibiscus, Chinese Rose—; *Pampangan*: Cayanga, Gomamila, Tapolanga, Tapuranga, Tarocanga—; *Persian*: Angara-e-hindi—; *Philippines*: Cayaga, Gumamela, Tapulanga, Tapuranga—; *Portuguese*: Flor de sapato—; *Rarotonga*: Kaute—; *Samoa*: Aute—; *Sanskrit*: Arkapriya, Aruna, Harivallabha, Japapushpa, Java, Joba, Odhrapushpa, Ondrakhya, Pratiko, Raktapushpi, Rogapushpi, Rudrapushpa, Trisandhya—; *Sinhalese*: Sapatthumal, Wadamal—; *Spanish*: Rosa de China—; *Tagalog*: Antolangan, Aroganan, Cayanga, Gomamila, Tapolanga, Tarocanga—; *Tamil*: Arattam, Irattai-chegappuchembarattam, Irattaimanjajembarattam, Mandaram, Sapattuppu, Sembarattai, Sevarattai, Sivandavesai—; *Telugu*: Dasanamamu, Dasani, Japapushpamu—; *Tulu*: Dasanapu—; *Uriya*: Mondaro, Odophulo, Onghribollika—; *Uruguay*: Flor de obispo, Rosa de China—; *Visayan*: Antolangan, Aroganam, Cayanga, Gomamila, Tapolanga, Tapuranga, Tarocanga—.

11. Hibiscus Sabdariffa Linn. is generally cultivated in the hotter parts of India and Ceylon. It is distributed through the tropics of the Old World.

The leaves are emollient. They are much used in Guinea as a diuretic, sedative, and refrigerant.

The leaves, seeds, and ripe calyces possess diuretic and antiscorbutic properties.

The succulent calyx, after the flower fades, is used for the preparation of jelly, chutney, curries, etc.; also as a refreshing drink or made into a wine or syrup. In bilious conditions, a diet drink is prepared by boiling it with water and adding a little salt, pepper, asafoetida and molasses.

East of Chad an infusion of the calyces, "Sudan Tea", is taken to relieve symptoms of plethora, for bronchitis and cough, and is also used as a vehicle for various native medicines. Externally the leaves, flamed to cause the sap to exude, are applied to assist the healing of sand-cracks of the feet, and a lotion is used for sores.

In Hausa the oil from the seeds is used as a substitute for castor oil and applied to camel sores.

Antsianaka : Voamahombazaha—; *Arabic* : Karkade, Karkangi—; *Basari* : Injangbam—; *Bengal* : Lalmista, Mesta, Patwa—; *Bombay* : Lalambari, Patwa—; *Burma* : Chinbaung, Chinpoungni—; *Canarese* : Kempupundrike, Pulachakiri, Pundibija—; *Ceylon* : Pulinchakira—; *Dagomba* : Dibemre, Digbemre—; *Deccan* : Lalambari, Patwa—; *Egypt* : Kerkadeb—; *English* : Indian Sorrel, Jamaica Sorrel, Red Sorrel, Rosella, Rozelle, Rozelle Hemp—; *Ewe* : Abema—; *Fra-Fra* : Bito—; *French Guiana* : Oseille-de-Guinée rouge—; *Fufulde* : Fulle—; *Fulani* : Follere, Follere ba'di, Follere boleyo, Hologo, Hoyoro—; *Ga* : Sakpa—; *Gbari* : Amma—; *Guinea* : Oseille de Guinée—; *Gujerati* : Lâlsheria—; *Gurunshi* : Nangana—; *Hausa* : Sure, Yakuwa—; *Hindi* : Lalambari, Patwa—; *Ho* : Arhaipila—; *Honduras* : Sorrel—; *Hova* : Divay—; *Ibo* : Ojo, Okworo-ozo—; *Konkomba* : Tingyanbam—; *Konno* : Sandoi—; *Kratchi* : Riaripari—; *La Reunion* : Groseille—; *Limba* : Bu-santor—; *Malayalam* : Polechi—; *Malinke* : Da—; *Mandingo* : Kucha—; *Marathi* : Lâl ambâdi, Patva, Tâmbâdi ambâdi—; *Mende* : Satoi, Satui—; *Mundari* : Arharjorjora, Jengaipillara, Jojoara, Telengaipillara—; *Nupe* : Emagi—; *Portuguese* : Rosela—; *Santal* : Arakkudrum, Togotarak—; *Sierra Leone* : Crincrin, Sour-sour—; *Sind* : Lalambari—; *Sinhalese* : Ratabilinchâ—; *Sokoto* : Sure—; *Susu* : Santon-belli, Santui—; *Tamil* : Simaikkasuru, Sivappukkasuru—; *Telugu* : Ettagomgura, Ettagongaka, Ettagonguru, Shimo-gonguru—; *Timne* : A-santor, Ka-santor, Koe-santoor—; *Tivi* : Aishwe, Ashwe—; *Tschaudjo* : Dibemre, Digbemre—; *Uran* : Kudrung—; *West Indies* : Red Sorrel, Rozelle—; *Wolof* : Bissab—; *Yoruba* : Amukai, Isepa—.

12. **Hibiscus surattensis** Linn. occurs in the hotter parts of India, from Bengal to Penang, and Ceylon. It extends to tropical Asia, Africa, and Australia.

The mucilaginous flowers are much used as an emollient and pectoral in La Reunion.

The Zulus use a lotion of the leaves and stem for the treatment of penile irritation of any sort, including venereal sores and urethritis. It is sometimes applied as an ointment for the same purposes. An infusion is also used as an injection into the urethra and vagina for gonorrhoea and other inflammations.

Benin : Akenye—; *Betsimisarak* : Sirangabalala—; *Bombay* : Ranbhendy—; *Burma* : Welmachinpoung—; *Ibo* : Ile ago—; *Lagos* : Wongo—; *La Reunion* : Oseille malabare—; *Malay* : Asam susor—; *Mende* : Koli-nei—; *Pojo* : Pode—; *Sinhalese* : Hinnapiritta, Naapiritta—; *Tamil* : Kashlikirai—; *Telugu* : Mulugogu—; *Timne* : Da-mirakanka, Damirasip, Ramirasip—; *Visayan* : Labog—; *Yoruba* : Awon-ekun, Wonjo—; *Zulu* : inCathucathu—.

13. **Hibiscus tiliaceus** Linn. occurs in all tropical regions, especially near the coast. It is particularly plentiful in the Sundarbans, and on the river banks in Burma.

The root is said to be febrifuge, and employed in the preparation of embrocations (Irvine).

The bark yields a dark hairy fibre which is used as an absorbent in Malaya.

In the Philippines the powdered bark is given as an emetic; an infusion of the leaves is employed to wash ulcers and wounds; the flowers, boiled in milk, are used in the treatment of earache.

In Gold Coast the yellow juice from the young fruits is rubbed on the skin to cure weakness.

In Indo-China the leaves are considered laxative and resolvent.

In Madagascar the plant is used as an emollient.

Australia: Cotton Tree, Talwalpin—; *Bengal*: Bala, Bhola, Bola, Chelwa—; *Betsimisarak*: Baro—; *Bombay*: Bellipata—; *Burma*: Thengben, Thinban—; *English*: Corkwood, Lime-tree-leaved Hibiscus—; *Fiji*: Fau—; *French*: Bois de not, Bois de hege, Grand Mahot, Varo—; *French Guiana*: Grand Mahe, Maho—; *Ga*: Fef—; *Guam*: Pago—; *Hawaii*: Hau—; *Hindi*: Bola—; *Honduras*: Mahoe—; *Hova*: Varo—; *Indo-China*: Huu nap, Tua iam chieu—; *Java*: Waru—; *Konkani*: Bellipata—; *La Reunion*: Foulsapate—; *Luabo*: moloa—; *Malay*: Ambaru, Baru, Baru laut, Dedap laut—; *Malayalam*: Nirparutti, Talipparutti—; *Manango*: Burfando—; *Mauritius*: Vaur—; *Mende*: Bome-kowei—; *Mexico*: Mahagua, Masagua, Masahua—; *Mortlocks*: Gili-lau—; *New Caedonia*: Borao, Borao de marais, Borao rouge, Bourao, Eemi, Eimi, He, Ven—; *Nzima*: Nwofwea—; *Pampangan*: Balibago, Raguindi—; *Panama*: Majagua—; *Philippines*: Malabayo—; *Ponape*: Kalahau, Kalau—; *Porto Rico*: Emajagua—; *Rarotonga*: Au—; *Sakalave*: Masaizano—; *Samoa*: Fau—; *Sanskrit*: Bala—; *Seychelles*: Bois var—; *Sherbro*: Papam—; *Sinhalese*: Belipatta, Beligobel, Belipatta, Bellipatta—; *Swahili*: Mtakawa—; *Tagalog*: Balibago—; *Tahiti*: Fau—; *Tamil*: Nirparutti—; *Telugu*: Ettagogu—; *Uriya*: Baniah, Baniya, Bariya, Kurubeli—; *Visayan*: Balabago, Malabago—; *West Indies*: Mahagua, Mahoe—; *Yap*: Kal—; *Zulu*: umLoio, umLoiwa—.

14. **Hibiscus Trionum** Linn. occurs in the Western Himalaya, Kashmir, Simla, Bengal, Sind, Konkan. It is distributed over Southern Europe and the tropics of the Old World.

In China and Malaya an infusion of the flowers is taken for itching and painful skin diseases, and as a diuretic. The dried leaves are held to be stomachic.

Brahui: Lasura, Pihupulli—; *Cantonese*: Wo Sheung T'au—; *Chinese*: Ho Shang T'ou—; *Egypt*: Aimbaggara, Shebbet, Til-shi-ami—; *Iraq*: Jiljil—; *Malaya*: Woh seong tow—; *Spanish*: Aurora, Malva vejigosa, Malva vesicaria—.

15. **Hibiscus vitifolius** Linn. is a common, herbaceous bush, in the jungles and brushwoods of the hotter parts of India, from the North-West Provinces to Ceylon. It extends to tropical Africa and Australia.

The plant is mucilaginous. The roots provide a preparation used by Gold Coast women to kill head-lice.

Bengal: Bankapas—; *Fanti*: Ekyi, Nkyetan—; *Sanskrit*: B̥haradvaji, Vana-karpasa—; *Telugu*: Karupatti—; *Yoruba*: Ofo odan, Okun agutan—.

(To be continued).

OBITUARY

H. H. SHRI KHENGARJI
MAHARAO OF CUTCH

1886-1942.

His Highness Maharajadhiraj Mirza Maharao Shri Khengarji Savai Bahadur was born in 1886 and succeeded to the ancient *gadi* of Cutch at the early age of 10. For close on 60 years, he ruled his State with beneficence and wisdom.

He was a scholar. His extensive reading, his close study of current events, and his coolly critical mind made him a just and liberal judge of men and affairs, whose opinion was listened to with deference and respect in the councils of the Nation. He represented India and his Princely Order at the Imperial Conference (1921). He was a delegate to the League of Nations. For many years, he filled with distinction the honoured position of Vice-Chancellor of the Chamber of Princes. He was one of the representatives of the Indian Princes at the Round Table Conferences which preceded the passing of the Government of India Act of 1935. In all these councils his wisdom and prescience were an asset to national politics.

But it is not in the performance of these high functions that one remembers Maharao Shri Khengarji. One remembers him not as a Prince and Elder Statesman, but rather as a man, simple, gentle, kindly, fair-minded, and considerate. He loved no ostentation or display. But his stately courtesy and charm of manner invested him with a natural dignity which impelled respect. As a man of many parts, he had many interests to compensate the cares of office, but he found his dearest solace in Nature. His association with the Natural History Society goes back almost to the year of its foundation. His name is included in the list of members, published with the second volume of the *Journal* in the year 1887: and through the years, he maintained his interest in the Society's affairs. He was elected its Vice-President in the year 1921 and became a Vice-Patron in 1924. In an early number of the *Journal*, published in 1893, there is printed a letter from the Maharao in which he records the taking of the eggs and young of the Flamingo (*Phoenicopterus ruber*) in his State. His Highness was the first to discover that the Flamingo (*Phoenicopterus ruber antiquorum*) breeds in India. Later he followed up the notice of his original discovery with a note on the 'Breeding of the Flamingo in the Rann of Cutch' (Vol. xv, 706). The data provided in his note enabled the Society 43 years later, to send an expedition to Cutch State. Thanks to the generous assistance received from the present Maharao, the Society was able to place on exhibition in the Prince of Wales Museum a magnificent group, illustrating the breeding of Flamingoes in the Rann of Cutch. The group, now associated with His Highness' name, is a memorial



MAHARAO SHRI KHENGARJI
MAHARAO OF CUTCH.
1886-1942.

to his discovery and to the consistent interest which he took in the work of the Society and the Museum. Both the Society and the Prince of Wales Museum have to acknowledge with gratitude his many generous benefactions.

His Highness was a great hunter. In a tribute published in *The Times of India*, on the 21st January 1942, Sir Geoffrey Archer, his companion in many hunting trips, wrote: 'His over-riding interest was sport; and not only did he blaze the trail in the matter of big game hunting and adventure in Africa for the younger generation to follow in his footsteps, but he travelled widely throughout Central Europe in pursuit of his favourite pastime. Because of his exceptional skill and knowledge as a hunter, coupled with a genial nature and his interest in everything around him, he was accepted wherever he went as a brother sportsman, as an aristocrat among aristocrats. Meanwhile, he himself was equally happy whether staying as a guest in a Polish castle or tucked away in a wooden hut among the snows and forests of the Carpathians and attended only by his tracker. With long experience as an African big game hunter, I can truthfully say that I have never known another case of such unrivalled enthusiasm for the chase (combined with a rare distinction in the choice of his trophies) retained to the very end of a long life. Moreover, he was observant and a good field-naturalist!'

The Society pays this tribute to the memory of a patron and friend, a sportsman and a great gentleman.

S. H. P.

REVIEWS

I.—COURTSHIP AND DISPLAY AMONG BIRDS by C. R. Stonor, xv + 140 pp. 57 plates (Country Life Ltd., London, 1940) Price 8/6 nett.

Exigencies of the times are responsible for the delay in the coming to our notice of this useful and absorbing book. The courtship and display behaviour of birds is one of the most fascinating branches of the study of ornithology. Increasing attention has been paid within recent years to the breeding biology of birds by field naturalists as well as by laboratory workers, and a mass of information has accumulated as a result of their investigations. A stream of observations continues to pour into ornithological journals, but it is seldom possible for the non-specialist, or for one interested in natural history in a general way, to keep track of all these records and to follow the progress and development of the study closely. The general reader has neither the time nor the facility for wading through the spate of current ornithological literature; thus he has good reason to be thankful to the author for the service he has done in bringing together all the most important information and presenting it in this readable non-technical form.

Darwin's theory of Sexual Selection was to the effect that the ornamental plumes and growths employed by male birds in their courtship displays were for the purpose of impressing the female before whom they were performed, and that these adornments were themselves the result of the selection practised by the female. Those males that possessed the most showy appendages and indulged in the most perfect display were chosen by the females, while their less showy and tardier rivals were rejected. Thus the responsibility for the continuance of further generations rested with the most resplendent and virile males who were enabled to hand down the desirable genes to their descendants. As the study of sexual behaviour progressed and became more intensive and critical, objections to the Sexual Selection theory—which had early made their appearance—began to multiply and grow. It soon became clear that the real significance of adornment and display was far less easy to explain than that theory implied. It is well known, for instance, that very often the female, far from consciously exercising her choice of a partner from among several displaying candidates, will take no interest whatsoever in their amorous antics. Indeed, not infrequently the male indulges in his display with undiminished ardour when actually no female is present. Or he performs in front of an inanimate object which, through some form of association, has excited his emotion. Again, in birds that pair for life such as storks, parrots and eagles, the Sexual Selection theory failed to explain why a fresh display ritual was necessary at the commencement of each successive breeding season since the mates were already chosen.

The social behaviour of birds that live in flocks during the several months of the year when they are not breeding, becomes so profoundly altered at nesting time that it seems natural to suppose that some sort of internal 'press button' must be necessary to switch on the birds' activities from the normal routine of flock-life to the specialised reactions of the mated pair. Experiments show that a number of extraneous factors such as increasing day-length in Spring (in the temperate regions of the earth) and the rainy season (in the tropics)—the abundance of food supply and the high bodily metabolism they denote—activate the endocrine or ductless glands in the bird's body. These glands secrete chemical substances known as hormones which pour into the blood stream and produce a magical stirring-up of the internal activities in the organism, both physiological and psychological. One of these glands in particular—the Pituitary, situated deep in the skull above the palate—is mainly responsible for the development of the gonads or sex organs, and controls all the specialised behaviour connected with the breeding cycle. Thus it is these hormones that are responsible for the courtship displays among birds. In species which are not sexually dimorphic, both male and female indulge in the displays to a more or less equal extent.

There seems no doubt that the biological function of courtship display—whether aided by form, colour or voice, or 'mechanical' (as the drumming of a woodpecker)—is the emotional stimulation of the opposite sex, normally the

female. It serves to arouse the necessary physiological urge, and to keep it at the pitch that will ensure fruitful copulation. This is the vital purpose of life—to perpetuate the species.

The multifarious types of courtship display range in different birds from the sublime to the ridiculous. They make fascinating reading. The special adornments of resplendent plumes possessed by the male Birds of Paradise and the effect with which they are displayed before their drab-hued mates are some of the most elaborate and spectacular—and even bizarre—performances in nature. It is in the fitness of things that an important place should have been allotted to them in the book. Mutual displays, practised by both sexes simultaneously, as the familiar bill-clattering of storks, form the subject of another chapter. These displays are also seen in Herons, Grebes and Albatrosses. Follows an absorbing section on Communal Display which has been closely studied in Gulls recently. Here the display and courtship ritual of one member of a breeding colony, who happens to be physiologically more ripe than the others, has an infectious stimulating effect upon the rest. It serves to rally the dalliants and to hasten the egg laying and other activities within the colony. Thus by shortening the total length of the breeding period these mutual displays help towards successful reproduction in a number of ways.

Other subjects, such as the yet imperfectly understood courtship displays or 'hilling' of Ruffs, the scrupulously clean display grounds and courtship behaviour of the Central American Mannakins (small birds of the size of wrens) and the elaborate and gaudily decorated bowers of the Australian Bower-Birds are discussed. The carefully selected and beautiful photographs that illustrate the volume add considerably to its charm and interest.

S. A.

II.—POPULAR HANDBOOK OF INDIAN BIRDS by Hugh Whistler, M.B.O.U., F.Z.S. Third edition. Illustrated. Gurney & Jackson, London (1942). Price 18/6 nett.

Whistler has become a household name with bird-lovers in India. Since the first edition of the Popular Handbook appeared in 1928, it has gained increasingly in well-deserved popularity. This third edition is still further revised and enlarged. It describes at length 300 species as against 275 in the second edition (reviewed on p. 171 of vol. xxxviii). Some more paragraphs mentioning other species have been added so that in all 550 species are now brought to the reader's notice. All the advances in our knowledge as regards taxonomy and distribution made principally by the recent bird surveys in various parts of India have been incorporated, bringing the work fully up to date.

The format of the book remains unchanged except that now it is fatter with the number of pages increased from 513 to 549. Apart from the letterpress there is one additional coloured plate (4 figures) and 9 extra figures in the text. All the features, debit and credit, commented on in the review of the second edition have been retained, including (unfortunately—we think) the size of the birds in inches, and the use of fractions of the inch, rather than millimeters, in describing eggs. This chronic conservatism must doubtless carry some hidden virtue in it, but which the reviewer has consistently failed to appreciate. Some of the curious illusions produced by giving the sizes of birds in inches can be seen, when, for example, the following are compared; Black-winged Stilt, length 15 inches; Common Teal, length 15 inches. White Ibis, length 30 inches; Bar-headed Goose, length 30 inches; Paradise Flycatcher, length 9 inches (excluding tail ribbons); Common Myna, length 8"—and these illusions cannot make things easy for the tyro and the layman.

P. 53: The song of the Spotted Babbler in the breeding season as 'of 5 notes repeated several times' is not a correct or happy description since it conveys nothing of the percussive, whistling and rambling nature of the performance up and down the scale.

P. 54: Quaker Babbler. 'The short song of 7 or 8 notes . . . ' is an inaccurate description, at least in so far as concerns the races *poiocephala* and *brucei* with which the reviewer is intimately familiar. In these forms the song is of 4 quavering whistling notes of the tone-quality of the Magpie-Robin's effort. It is repeated every few seconds as the birds move about the foliage.

P. 63: Chloropsis. Strangely enough no mention at all was made of the mimicking powers of the Chloropses in the second edition. And as this is such a characteristic feature of the calls of these 'Bulbuls', we are glad to see due prominence given to the trait now.

P. 98: The song of the Plumbeous Redstart, it may be mentioned, is an 'identical twin' of that uttered by the Fantail Flycatcher *Leucocirca albicollis*. The reviewer has been taken in on more occasions than one in localities where the flycatcher was absent.

Frequently where short mention of a species is made, insufficient clues are given for its identification or for differentiation from allied birds, e.g. Crag Martin (p. 231) and Nilgiri Swallow (p. 234).

On pages 267 and 268 we find that 'Habits' of Tickell's and the Thick-billed Flowerpeckers have been greatly embellished. The language and matter seem oddly familiar, and indeed almost word for word is what we have seen published elsewhere! Yet no recognition of the source or the authorship appears. When the original work of others is quoted in extenso, it seems unfair that it should not be properly acknowledged, although we have no doubt that in the present case the omission is purely inadvertant.

P. 416.—The new race of Bush-Quail—*sālimālii*—recently obtained on red laterite soil in Mysore State is surely of the species *P. argoondah* and not *P. asiatica*, as stated.

Apart from these, and a few other minor criticisms, we have nothing but praise for the book. In its present form it is all that one could wish for for getting acquainted with our birds and for use as a stepping stone to a deeper study of the ornithology of this country. We wish it all the success its predecessors had.

S. A.

III. THE MAMMALS OF INDIA. The Fauna of British India including Ceylon and Burma. (Published under the patronage of the Secretary of State for India). Edited by Lt.-Col. R. B. Seymour Sewell, Mammalia, vol. ii; Carnivora, continued from Vol. i, Sub-Orders Aeluroidea (part) and Arctoidea. By R. I. Pocock, pp. xii+504+12 Plates (London Taylor and Francis, Ltd., 1911). 35s.

Mr. Pocock's second Volume on Indian Mammals commences with the Mongoose (Hesperidae) and includes the Hyenas (Hyaenidae), Wolves, Jackals, Foxes, Wild Dogs (Canidae), Bears (Ursidae), and that heterogeneous collection of smaller mammals the Pandas, Otters, Weasels, Martens, Stoats, etc. grouped by naturalists in diverse combinations, but here assigned to the Ailuropodidae, Ailuridae and Mustelidae.

The system followed is similar to that adopted in the previous Volume. Descriptions of Families, Sub-families and Genera are followed by descriptions of the species and of races, based on descriptions of individual specimens. Keys are provided based on external and also on cranial characters. To one accustomed to Blanford's work the wealth of detail in description is perhaps confusing. But Blanford's Mammalia was written mainly on the pre-Darwinian lines on which the earlier naturalists in India worked. Their observations were limited to describing the salient characters by which one species could be differentiated from another. Blanford's work as such was limited mainly to generalised descriptions of the distinctive characters of each species. But today it is considered equally, if not more important, not only to classify species, but systematically to record such variations as may be exhibited by them. These differences, even if they are trivial, provided they are constant, furnish data for the investigation of problems related to the evolution, variation and distribution of species. In the present Volume, the author provides in almost meticulous detail not only full descriptions of geographical races wherever these have been established, but also records of seasonal and individual variation. This is the outstanding character of Pocock's work and its distinction from the older publication on Indian Mammals. Equally important is the systematic part of the work. The author's revision has been directed to the clarification of the status and nomenclature of numerous forms and species of Indian Mammals, described by various authorities. The confusing plethora of names adopted by them and, frequently, the vagueness of descriptions has made such revision a most difficult task. Mr. Pocock's great knowledge and experience

as a systematist, that thoroughness and precision which is characteristic of his work has enabled its accomplishment. The author had the advantage of being able to study far larger collections than any of the older naturalists. The most important were the extensive collections of Indian mammals brought together by the Bombay Natural History Society's Mammal Survey. The new *Fauna* is essentially a product of this Survey and is a memorial to the Society's enterprise. The author's exhaustive study of these and other collections incorporated in the present work has meant a considerable clearing of the confusion which hitherto hampered the systematic study of Indian mammals. The new *Fauna* is an index to the present day knowledge of the subject, and provides a sound foundation upon which future knowledge may be built up.

We pass now to a brief review of some of the changes noticed in the systematic part of the work. Pocock's revision of the Hesperidae (Mongoose) has resulted in a reduction of the number of British Indian species from 8 to 6. The Brown Mongoose of Ceylon (*Herpestes fulvescens*), hitherto regarded as a distinct species, is now considered a racial form of the Brown Mongoose (*H. fuscus*) of the South Indian hill ranges. The Small Burmese Mongoose (*H. burmanicus*) also loses specific rank and becomes a racial form of the small Mongoose which ranges from Persia, eastwards through North India and Burma. A reduction is also made in the number of hitherto recognised sub-species. Wroughton, Thomas and Miss Riley differentiated and described in our *Journal* a number of races based on distinctions in colour and coat, which examination of more material has proved to be purely seasonal and without racial significance.

Coming to the Canidae, the Indian Hyaena, so far recognised as a distinct species, now becomes a racial form of the Hyaena which ranges from Africa through South-West Asia to India. The wolf of the Indian plains, also recognised by Blanford, as a distinct species, becomes a racial form of the European Wolf (*Canis lupus*), which is represented in Kashmir and the Himalayas by a second form the Wooly Wolf (*C. lupus chanco*). This Himalayan race absorbs the numerous so-called species and forms described from Kashmir, Central Asia and China on characters ascribed by Pocock to seasonal and individual variation. The Indian Jackal, like the Wolf and the Hyaena, also loses its specific status and is regarded merely as a race of the Asiatic Jackal, (*Canis aureus*), which ranges from South East Europe through South West Asia, India and Ceylon to Siam. Four racial forms of this Jackal are now recognised from Indian limits. Like the European Wolf, the European Fox (*Vulpes vulpes*) extends its range into our limits. It is represented by a Himalayan race, *Vulpes vulpes montana*, a more westerly form from Afghanistan, *V. v. griffithi*, and by a desert form, *V. v. pusilla*. The last, Blanford recognised as a distinct species under the name *V. leucopus*. Even our Wild Dog (*C. dukhunensis*) and the Malay Wild Dog (*C. rutilans*), which so long enjoyed the dignity of distinct species, become races of a Wild Dog (*C. alpinus*), generally distributed in Central Asia and the Oriental region. Thus of all the dog tribe India proper can now claim a single indigenous species—the Bengal Fox (*V. bengalensis*).

The Brown Bears of the Tian Shan Mountains, the Pamirs, Afghanistan Waziristan and the North West Himalayas, separated by naturalists in the past into numerous races and species, are now grouped within the compass of a single race of the European Brown Bear (*Ursus arctos*). Distinctions in the size and shape of the cranium and the teeth, hitherto used by scientists, to differentiate them have proved, on the examination of more ample material, to be nothing more than instances of individual variation. Does a Brown Bear occur in the Shan States? Thomas described the so-called Burmese Brown Bear (*Ursus arctos shanorum*) from a specimen alleged to have been obtained in the Shan States. It was sent to the British Museum by the Indian Museum and was originally received from a dealer in wild animals. Pocock doubts the correctness of its origin as no Brown Bear has hitherto been recorded from any locality near the Shan States. Another question which yet remains to be cleared up is the existence of a form of the European Brown Bear in Baluchistan. Blanford described one from Gadwar on the Mekran Coast under the name of *Ursus gedrosianus*, but later he considered it to be a 'brown' example of the Himalayan Black Bear (*U. torquatus*). In the present Volume, it appears as a race of this bear. The existence of a 'brown' bear in the hills of South Persia, in a terrain similar to the arid hills of the Mekran, has since been noted, but whether this bear is a racial form of the European Brown Bear or Himalayan Black Bear remains to be discovered. That the Himalayan Black Bear may have a coat brown enough to be mistaken for a brown bear is

evidenced in the example killed in Kashmir and mentioned in the present Volume. Another specimen of the 'brown' type was recently shot in the Nepal Valley and recorded in the *Journal*. Our Sloth Bear may also exhibit a brown or cinnamon phase of colouring. The Maharana of Dewas (Senior) has a large 'brown' sloth bear now alive in his Zoo. The Himalayan Bear, the Malay Bear and the Sloth Bear are now grouped by Pocock in three separate genera.

The new *Fauna* devotes 10 pages to the Giant Panda to which Blanford made brief reference at the tail end of his chapter on Bears. Systematists are not agreed as to whether the Giant Panda is a Bear or a type of Raccoon. It has something of both, and is yet neither the one nor the other. Pocock places it in a family by itself—the Ailuropodidae—, between the Bears and the Pandas. The Giant Panda is not found within Indian limits. Pocock suggests that it may turn up in the near future in the mountains of Upper Burma. If they are there let us hope they remain undiscovered. Since the introduction of these interesting animals into European and American Zoos they have become 'celebrities' and as such have been subjected to intensive hunting which may well have led to their extermination. The skull of a giant Panda discovered in a cave in the Ruby Mines District, reveals the one time existence of a Giant Panda in Burma which, the author regards as a distinct species, exterminated in comparatively recent times.

Pocock's revision of the Mustellidae has resulted in the creation of six as against three sub-divisions of the family with which Blanford was content. The Ferret Badgers, the Badgers and the Ratels are now placed in three separate sub-families. The Otters, a distinctive branch of the Mustellidae have received the treatment necessary to unravel the confusion of forms and species, under which their exact identity lay buried. The three Indian species included in Blanford's work under the single genus *Lutra* are now separated in three separate genera. An interesting point connected with the distribution of Indian Otters has been brought to light as a result of Pocock's study of the specimens collected by the Mammal Survey. The Common Otter (*Lutra lutra*) and the Clawless Otter (*Amblyonyx*) appear to have the same discontinuous distribution as the Tahr and the Pine Marten, being found in the Himalayas and nowhere else in India except in the hill ranges of the south. A similar phenomenon characterises the distribution of the Indian Yellow-throated Marten (*Charonia*). But why this Marten which lives under most varied conditions in the northern portions of its range is absent from the whole of Central India is a riddle which remains yet unanswered. The Indian Martens placed by Blanford in the same genus as the European Marten (*Martes*) are now placed in a separate genus, for which Pocock has resuscitated Gray's sub-generic name *Charonia*. The exact status of our Weasels, Polecats, Minks and Stoats is as yet unsettled. The British Indian species are grouped by Pocock in three genera: *Mustella* to include the Stoats and Weasels, *Putorius* for the Polecats, and *Vormela* for the Marbled or Tiger Pole Cat which is now admitted, on all hands, to represent a distinct genus. The Ferret Badgers (*Helictis*) which have been classified in many genera and species are now once again grouped in a single genus. Equally confusing have been the varying conclusions regarding the status of the Hogbadgers, (*Arctonyx*) of which so many forms and species have been described. Pocock, accepting the verdict of recent American authorities, recognizes but a single species represented in the various areas of its wide range by racial forms, two of which occur within Indian limits. The Volume ends with the Ratels *Melivora*. Here again Pocock sweeps aside the many so-called species and regards them all as racial forms of a single species ranging from Africa through Southern Asia to India.

For that part of the book dealing with the habits of Indian animals, Pocock has relied on the writings of various hunters and field naturalists. One misses the fervour and individuality which Blanford's experience of the Indian forests gave to his writings. Nevertheless what has been selected by Pocock for inclusion in the present Volume, epitomises the essentials of what is known today about the habits of Indian Mammals. Much of this knowledge has been taken from contributions made by members of the Society to the pages of our *Journal*. The book is illustrated by a number of plates, many of them the work of the author.

Mr. Pocock is to be congratulated on this outstanding contribution to the progress of Indian Systematic Mammalogy. His work provides a solid framework on which students may build. It removes many of the obstacles

which handicapped this study, but a perusal of the work will show that many problems relative to the status and distribution of Indian Mammals remain to be cleared up. The desirability of further collections by private individuals has not been lessened but increased. Series of specimens with records of date and locality in which they are collected are still required particularly if collected at different seasons of the year. The collections of the Mammal Survey upon which the new *Fauna* is largely based, were in any given area, mostly made at one season of the year and many areas have been left untouched. The private collector has still before him a wide field for his efforts.

S. H. P.

MISCELLANEOUS NOTES

I.—ADAPTIVE COLOURATION OF DESERT ANIMALS

In a recent paper (Birds of Bahāwalpūr—Punjab) which was published in this *Journal* in December, 1941 (vol. xlii, No. 4, page 706) the author, Mr. Salim Ali, has written a section on desert colouration, which is rather misleading and leaves out the more recent work on adaptive colouration.

In the struggle for existence which is for ever going on in Nature, the primary needs of an animal are sustenance and security. To achieve these needs Nature has used many methods varying from the evolution of speed to the chemical warfare in which some insects are adepts. Of these colouration, adapted to the needs of the animal, is an important factor, whether it is used for concealment, warning or as a disguise.

In the desert the main type is concealing or 'effacing' colouration. It has long been a criticism that immobility is necessary for effective concealment, and as one of the properties of animal life is movement, how can any colouration be effective? There can be no doubt that immobility is a very important factor, as it is known that many animals react almost exclusively to visual *stimuli* in the form of movements by their prey, but it is equally certain that cryptic colouration is not valueless during movement. It is a principle which is made use of, in a reverse manner, at every cricket match to make the ball more visible to the batsman. If white side-screens were not provided the ball would tend to melt into the background and may even apparently disappear. With a white background, however, the red ball is perfectly clear for the whole distance after leaving the bowler's hand. There are numerous other practical applications especially at the present time in war-time camouflage. The modern camouflaged soldier is much less readily discernible than his scarlet uniformed predecessor, whether moving or not. Biologically it is best illustrated in the snow-lands where a small dog is visible when it is chasing the white arctic hare at distance from which it is impossible for the on-lookers to see the hare. Of course, at close range, the hare is visible; even its concealing colouration cannot hide it. But once the hare gets well ahead of the dog, the latter immediately loses sight of him, although the hare is still moving.

To summarize, it appears that the vision is attracted to any colour not in harmony with the background and by movement. To be perfectly concealed the animal must be immobile and harmoniously coloured in relation to its surroundings. But it is equally obvious that, whether at rest or in motion, an animal exhibiting concealing or cryptic colouration will obviously be more difficult to see than one out of harmony with its surroundings, and this is more obvious at a distance.

Consequently it is fair to conclude that far from only 'giving protection from chance predators' concealing colouration does give the animal a good deal of protection. What cannot be overstressed is that it does not give the animal complete protection, but quite obviously those with it have an advantage over those without it, and the latter are eliminated in the ruthless struggle for existence.

The associated subject of colour-perception in animals has unfortunately been insufficiently explored to make any generalisations as to the visual effect of protective desert colouration to animals other than Man. It can be said, however, that our range of vision shows us a really remarkable adaptiveness to the colour of their surroundings in several groups of animals. To animals with a less range of colour vision, the colours that they cannot perceive will be replaced equally in the colouration of the animal and of the background, by the next most intense colour component of the light, or if the colour is pure by black.

With regard to the origin of this colouration it is possible to speak with more authority. Although I have not seen the original paper by Col. R. Meinertzhagen's, from Mr. Salim Ali's paper I understand it to claim that the light pigmentation of desert animals is due to the large amount of ultra violet radiation which gets through. Neither this nor any other atmospheric condition, can account for the cases quoted below, more details of which can be found in Capt. H. B. Cott's book *Adaptive Colouration in Animals*. (London, 1940).

On an island in Dublin Bay, Ireland, there is a pale-coloured form of the house mouse found on the sandhills. The narrow stretch of water separating the island from the mainland has prevented any addition to the colony from the mainland, where the house mouse is of the normal dark colour, and it has now become colour-adapted to its new habitat.

An even more striking example is found in the Tularosa Basin, New Mexico. Here dark forms of rodents can be found living on the black larval beds, which are a feature of that locality, but in the surrounding desert the rodents are light-coloured, and of the typical desert colouration.

In neither of these cases is it a case of atmospheric conditions, as both are living under practically the same conditions and yet are differently coloured. It can only be explained as a direct result of natural selection eliminating the colour variants unsuitable to their surroundings, and thus gradually establishing a new colour race adapted to its environment.

Further any theory of animal colouration should embrace the whole of the subject, and no atmospheric conditions can account for the remarkable behaviour of the arctic animals, whereas it is clearly understood if one considers the needs of the animal for security and to enable it to obtain its food. Why, for instance, should the reindeer remain brown all the year? Why should the hare change from brown in summer to white in winter? Atmospheric conditions are the same for both, and are the same for the polar bear which remains white! The reindeer and hare both

have a vegetable diet, so the change must be connected with the security of these animals. And it is so, the reindeer has no enemies, whereas the unfortunate hare has many, and only survives with the aid of his concealing colouration. In the case of the polar bear, the struggle for existence relaxes in summer. Food is plentiful, but in winter there is famine, and then the cryptic white colouration assists it immeasurably.

To conclude I must acknowledge my enormous debt to Capt. H. B. Cott, who first interested me in this subject, and who, if he were available, is infinitely more competent to deal with this subject. As far as possible I have followed his new terminology, but as his book is not available at present, I have been somewhat handicapped in this respect. Further, I cannot do any better than to refer anyone for a complete account of adaptive colouration of animals to this work.

PHILLAUR,

PUNJAB,

9-1-42.

T. W. BURDON, B.Sc.,

Indian Police

II.—THE WOLF (*CANIS LUPUS* LINN.) IN BALUCHISTAN.

In July 1941 I came across two wolves at about 11 o'clock one morning near Anjinai (Kakari Khorasan). I was riding along a path when they suddenly appeared at a canter, crossed the path 100 yards ahead and disappeared into some hills. I followed on foot but never saw them again. These wolves were about the size of Alsations though of leaner and longer proportions. They were of usual grey colour and markings as far as I could see.

A snowfall occurred in December: three days later two wolf skins were brought in to Quetta for the usual rewards. One was of the normal grey colour and measured about 4 ft. 6 ins. length: the other was a magnificent creamy white one with a faint orange tinge down the centre of the back and a few black flecks in the sides and tail. This skin which I have had cured measures 5 ft. 10 ins. in length.

The wolf was one of three which chased an inhabitant of Jalogir, a village situated 19 miles from Quetta on the Chaman road, into his house; the man told me that he only just banged his door in time as the wolves were close on his heels. He then seized a spade, cautiously opened the door and was confronted by the white wolf which he knocked on the head with his spade, whereupon the other two made off.

A heavy fall of snow occurred in January. A few days later I was informed that three men had been killed and eaten and one bazaar sweeper badly mauled during the night by a pack of wolves close to Hindubagh in the Zhob valley. I have had no confirmation of this report.

From enquiries made it is apparently very uncommon to find white wolves in this Province.

The following questions naturally present themselves :—are such wolves albinos, do some of them turn white in winter or are they of a different type and distinct from the ordinary wolf? As regards the first this skin was brought in with the head which had not at the time been skinned, the eyes did not appear to be pink and moreover there are black eyebrows over them; the possibility of its being an albino is therefore precluded. The fact that the skin of another wolf of the ordinary grey type, size and colour was brought in on the same day, combined with the fact that white wolves are so rarely seen in these parts conduces to the belief that the ordinary type does not change to white during the winter. For want of further information on the subject therefore one is led provisionally to the conclusion that the large white wolf whose skin I now have is of a distinct and unusual type to that ordinarily found in Baluchistan. I should be grateful for any further information on the characteristics and distribution of such wolves.

24, LYTTON ROAD,
QUETTA,
January 25, 1942.

R. K. M. BATTYE,
Captain.

[The wolves which inhabit India and Baluchistan are racial forms of the European Wolf. Within this area two races are recognised: the Woolly Wolf, *Canis lupus chanco*, recorded, so far, from the Western Himalayas, Kashmir and Chitral, and the Small Indian Wolf, *Canis lupus pallipes*, distinguished by its smaller size and its shorter and less luxuriant winter coat. This race occurs in Baluchistan and the Peninsula of India. Intergradation between the two races, makes distinction difficult, particularly in an individual inhabiting the border lines of the two races. In the winter coat of the woolly race, the dorsal surface and the tail are, to a greater or less extent, variegated with black and white or black and buff contour hairs which are especially profuse on the back forming a definite 'saddle'. In the peninsular race the dorsal 'saddle' of the winter coat is sandy fawn and heavily blackened by the black tips of the contour hairs; but the fawn may bleach to grey, the black be much reduced in extent and intensity. We have examined the skin sent to us by Capt. Battye which appears to belong to the smaller race. Its pelage is exceptionally pale, showing a tendency to partial albinism. Eds.]

III.—EXTENSION OF RANGE OF THE MARBLED POLE CAT (*VORMELA PEREGUSNA* GÜLD.).

I should be very grateful if you could classify the animal depicted in the 2 enclosed photographs and let me know what it is.

We found it about 3 weeks ago in one garden where presumably it had been deserted by its mother. Its main colouring and distinguishing marks are:—

1. Underneath of neck and all down its stomach—jet black and very velvety fur.
2. Remainder of body including head and tail—black with cloudy yellow bars.
3. Very pointed upright ears.
4. Small black eyes.
5. Pads and claws rather like a miniature bear. The claws are definitely not sheathed like the cat tribe's.

It is an excellent climber, is now very tame, answers to its name and runs all over the garden.

I should say its age is probably now 6 or 7 weeks old, as its teeth are well through.

It runs with a curious arching of the back motion.

Personally I should say it is either a Marten or Weasel. The local Pathans have a word for it '*Dalagai*' and say it is fairly common and lives on rats and snakes.

Parachinar where the animal was found is 6000 feet up and has a high range behind it which runs up to over 15,000 feet (the Safed Koh).

KURRAM MILITIA,

PARACHINAR, N.-W.F.P.

May 27, 1942.

R. S. JOHNSON,

Major.

[From the photographs submitted, the animal is undoubtedly a Marbled or Tiger Pole Cat (*Vormela peregusna*). A local race (*alpherakyi*) is recorded as occurring in within our limits in Afghanistan and Baluchistan. The present record from the N.-W. F. P. is an extension of its recorded range. Eds.]

IV.—NOTES ON THE PANGOLIN (*MANIS CRASSICAUDATA*¹).

(With two text figures and a plate).

A female specimen of the Indian Pangolin, *Manis crassicaudata*, caught at Mettur was recently (October 1941) received at the Madras Government Museum. It came to us in a very weak condition, so that it survived in captivity only for a fortnight. The animal used to produce the characteristic hissing noise. On the first day when termites were put in the cage, it ate even the clay.

¹ From the pleistocene deposits of the Karnul caves, fossil relics of a large species of *Manis*, *M. gigantea*, which should have been 4 ft. 6 in. in length, have been described by Foote and Lydekker,



Fig. 1.—Pangolin (*Manis crassicaudata*).

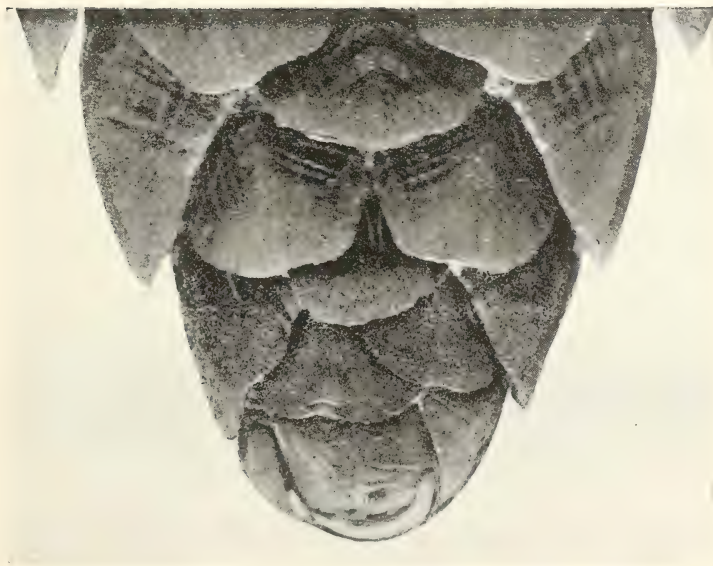


Fig. 2.—Ventral view of tail showing genito-anal region.

To relieve the congestion in the stomach it was given plantain fruits, which it ate, but how, we could not observe. Later it was given an easing dose of castor oil which had the desired effect. Even during day time, it lapped up water. When it was found to languish, on the last two days, it was given minced mutton, which it ate on the first day, but not on the second.

One night, when an electric torch was flashed into the cage, the animal was in the act of getting down from a shelf to the bottom of the cage. The tail was laid flat on the horizontal plank and as the animal slid down, the tail was bent almost at a right angle at the edge of the plank. This showed that the tail can be used as a prehensile organ.

Post-mortem examination showed the cardiac portion of the stomach to be almost empty except for a few grains of sand while the pyloric region contained remains of black ants.

The total length of the animal from the tip of the tail to the snout was 34 ins. and the tail (measured from the anus) was 13 ins.

The tongue protruded about 9 ins. from the mouth. The animal weighed $8\frac{1}{2}$ lbs.

Another female specimen which was killed by the driver of a motor lorry at Poyman-malai, twelve miles south of Salem town was brought to the Museum in a sufficiently good condition for observations to be made on it (Figs. 1, 2 and 3).

The ear.—In this specimen the scales of the head extend to the upper border of the ears. The pinna lies vertically across the space between the margin of the head-scales and the glandular pad under the neck. The fold of the pinna is 4.5 mm. thick, quite stiff, and densely covered anteriorly and laterally with downy hair. This specimen corroborates Pocock's remark that 'the ear of *M. crassicaudata* is apparently similar to that of *M. javanica*'.¹ In the stuffed specimens, the ear appears to be less prominent.

Claws, etc.—The relative size of the claws of the fore and hind-feet are respectively $3 < 4 < 2 < 1 = 5$, and $3 < 2 < 4 < 1 = 5$. In the fore-foot, the third and the fourth claws are blunted, and the fifth has a flat tip. There are two pads on the fore-foot but these are smooth whitish, in contrast to the dark highly granular pads of the hind foot. Of the two pads on the fore-foot, the outer is smaller than the inner one which is $\frac{3}{4}'' \times \frac{1}{2}''$.

Scales of the head, body, limbs, and tail.—There are only slight variations in the size of the scales in the head, the number of median scales varying from ten to twelve.

Only one stuffed specimen in the Presidency College of which the locality is not known has 15 rows of scales on the body, all the rest having only 13 rows. A varying number of abdominal scales are keeled, some having only three scales on each side keeled. The largest number of keeled abdominal scales, eight on each side, are found in the Presidency College specimen.

¹ Proc. Zool. Soc., 1924, p. 709.

The lateral scales on the fore-limbs are in continuous lines with those on the back, while there is a break in continuity between the latter and the scales on the hind limbs. A number of scales on the limbs also are keeled, the number of such keeled scales being as few as four in some, and as many as eight to ten in others.

The number of median dorsal scales on the body is 14 inches in one of the specimens and 16 in all the rest. The number of rows in the broadest part of the tail is 10, except in the Presidency College specimen which has 12.

The anterior-most ventral scales are not set in a line (Fig. 2) and their arrangement is different from that in *M. javanica* and *M. pentadactyla*.

Figs. 2, 3 and 4 illustrate the variability of the terminal ventral scale of the tail. In fig. 3 the terminal scale and those preceding it are symmetrically set; they are more symmetrical than in the other specimens (figs. 2 & 4). The markings on the terminal scale

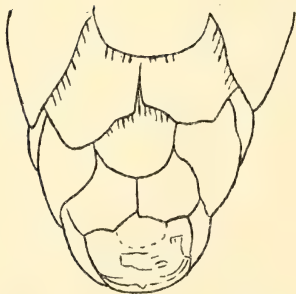


FIG. 3.—Ventral view of tip of tail specimen from Mettur

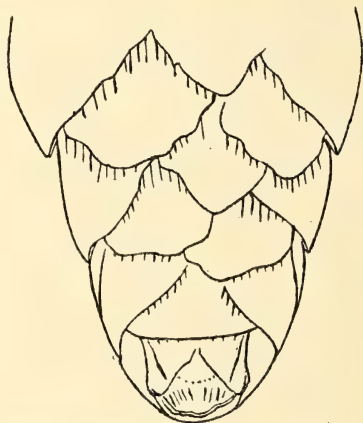


FIG. 4.—Ventral view of tip of tail specimen from Madras

appear to suggest that several scales have been fused together in its formation. The terminal scale in most specimens shows evidence of considerable wear.

Of four specimens measured, two have their tails 45% of the total length, and two about 39%, while the maximum breadth of the tail is nearly the same in all. The Presidency College specimen has the relatively broadest tail in proportion to its length.

Genito-anal region (Fig. 2).—The vulva is a slit situated on a slight eminence enclosed except in front by a puckered ridge, within which is the anal aperture, immediately behind the genital eminence. The mammae are pectoral, extremely small, and tipped dark.

The throat gland.—In the specimen from Salem District the throat gland is very prominent. It is thick, light pink in colour,

and smooth in contrast to the surrounding skin which is dark brownish and coarse to the touch.

GOVERNMENT MUSEUM,

A. AIYAPPAN.

MADRAS,

March 4, 1942.

V.—WHY 'RED-BILLED' BABBLER?

Can any one explain why this attractive little bird bears the apparently very inappropriate name of the Red-billed Babbler [*Stachyridopsis pyrrhops*] (Blyth)? I recorded the soft parts of several specimens very carefully when in India and although the iris is marked as crimson in the male and red in the female (and as deep red-brown by my friend Mr. A. E. Jones) I find that the bill has been noted as 'dark brown, lower mandible livid' or variations on that description.

Jerdon (B. of I. ii. p. 21) gives the bill as 'sordid sanguine'. Was this a mistake and was the English name based solely on that mistake? or is it possible that the bill changes colour in the breeding season? My specimens referred to above were collected in winter.

CALDBEC HOUSE,

HUGH WHISTLER.

BATTLE,

November 22, 1941.

VI.—EXTENSION OF RANGE OF RUFOUS-NECKED SCIMITAR BABBLER (*POMATORHINUS RUFICOLLIS* HODGS).

It might interest you to know that I came on a small party of 3 or 4 Rufous-necked Scimitar Babblers (*Pomatorhinus ruficollis*) No. 125 of F. B. I. 1st edition at a height of 6,900 feet near Duran Forest Rest House about 18 to 20 miles south-east of Almora of which I shot one. The rufous feathers on the neck formed practically a complete collar round the neck. I cannot find this species as having been recorded west of Nepal before. Would you let me know if its appearance where I found it, was unusual. The party of these birds was in thickish undergrowth about 10 feet from the ground when I came across them and the one I shot was at the moment hanging upside down at the end of a branch after the manner of tits.

GONDA, U.P.

W. A. HEWITT,

September 30, 1941.

Dist. Traffic Supdt.,

B. & N. W. Rly.

[The range of the Rufous-necked Scimitar Babbler (*P. ruficollis ruficollis*) is given in the *Fauna* (2nd edn.) as 'Nepal to Eastern Assam; north of the Brahmaputra.' Eds.]

VII.—A VISIT TO MASKAN AND AUHA ISLANDS IN THE PERSIAN GULF, OFF KUWAIT. MAY 7th 1942.

I had some days previously consulted one Ibrahim al Fauderi, the light keeper and fisherman of Maskan, (pronounced Maschan) as to the best time to pay a visit to Auha Island, as I wanted to see the birds nesting there. He told me that last year his sons had visited the island on the 23rd of the Arabic month (Ra-biūth-thāni) and had collected some 150 eggs which they had sold in the Kuwait market.

'The Pleiades will set on the 25th of the month,' he said, 'and if you could come about the 21st the weather will be favourable for the expedition.'

I asked him to come again and see me a few days before it was time to go to enable me to make final arrangements. He came and saw me on the morning of May 5th and said that he had heard that his sons were proposing to go to Auha to collect eggs, but that he had forbidden them to do so as the 'Khatun' wished to go with them. So he advised an early departure.

All plans were made to leave Kuwait on Thursday morning early, the 7th May. I arranged to take with me our Badawin servant Salim al Muzeyin, who at one time had been a pearl diver, and his niece Amsha. A small 30 lb. tent, a camp bed and bedding, two local made rugs and a couple of cushions was all my kit consisted of. As a present to the family, whose guest I was going to be, I took half a sack of Karachi rice, half a sack of flour, one wagiye of 'Dehen', one wagiye of coffee, and a maund of firewood.

Early Thursday morning the sailing boat came into the harbour in front of our house in Kuwait, and the tide being high we soon loaded up our kit and were off on a nice westerly breeze. This breeze veered slightly two hours or so later, and we had to sail away to the north-west of the island. We eventually arrived at Maskan at 11.30 am. in a very hot steamy atmosphere. Ibrahim's home, a collection of small low stone built huts, stands on the west shore, while close to these is the navigation white light which is hoisted on a mast every evening at sunset. One tamarisk tree some 20 yards away provides shade for his cows and sheep during the noon-day sun.

The island is about thirty acres in size, and contains two good cement water tanks which are filled up from the rain water each year. There is good grazing, and brushwood in the shape of 'Shinan' (*Anabasis setifera*) which cover the island. These bushes are broken down—not pulled up by the roots—each autumn, when they are dry, and collected as firewood. Each spring and summer

the bushes shoot out again giving a very nice green appearance to the island.

Ibrahim's livelihood is fish which he and his sons catch in their traps and bring to the Kuwait market.

His family were made up of the wife, three grown up married sons with their wives and small children, his married daughter and three small daughters of five, eight, and ten years old. The ladies had a private sitting out place or 'arish', on the edge of the shore and near their house, rigged up from spare boat masts and poles, and roofed with the reed fish trap and Iraqi mats.

I pitched my tent just beyond this, and sat by day under the shade of the 'arish' on a mattress and cushions. Except for an hour or so before noon there was either a south or west wind blowing and it was delightfully cool for this time of year. Two nice cows came in to be milked at early noon, then rested under the tree till about 3 p.m. when they were milked again before wandering off to graze or pick up any odd dried fish which lay about. At sunset each cow was tied up and given a meal of date stones or a few dates, which they ate out of the empty shell of a large turtle. Some eleven sheep and goats also came in at dusk and were tethered up for the night under the tree.

The women of the household cooked me a most delicious lunch of rice, both sweet and plain, a variety of fish cooked in several different ways, dates cooked in honey, as well as a bowl of leben. For supper more rice and fish and an omelette of pigeon's eggs with butter sauce, and as an aid to digestion a glass of water flavoured with the pollen of the male date palm.

From midnight onwards a south wind blew and there was a very heavy dew. It was not possible to sail to Auha the following morning as I had hoped. So another day was spent lazing about on the island during which I went bird nesting with the children, and watched the men make their fish traps out of new reeds from Iraq, while others beat out the stems of the fruit of the date palm for rope to bind them with. This fibre is known as 'Assu'. These fish traps have to be continually renewed as storms break them easily. The fish caught were mostly 'Zobeidi', 'Subaity' Sha'am', at the time of my visit, though in the fish traps were usually as many as a dozen large stinging ray and their young ones. Ibrahim and his sons had at one time or another all been stung in many places on their legs by these vicious creatures and had been laid up for months at a time. Apparently the sting of the young ray can poison one as much if not more than that of the large ones.

After dinner on the first and second evenings of my visit the lady of the house sat with Amsha and myself outside my tent and told us stories of the desert.

She was originally a Badawin girl, she said, her father being of the Shammar tribe and her mother an Aniziyeh, and she was brought up at the village of Aiyun close to Hail.

'In those troublous times,' she said, 'everyone carried rifles and the men would not think of going to the mosque to pray without one. Even girls were all taught to shoot and ride a mare'.

'Round about Hail, it was very hilly country and many deep caves existed in the hills. There was always a danger to our flocks and herds as panthers and hyaenas would come out at nights and try to steal our goats and sheep'.

'My mother told me the story of how when I was only a tiny baby of two months I was nearly carried off by a panther. My father had gone to the mosque to pray at sunset, while she accompanied by myself, then a tiny child of only two months, returned home with the flocks. When my father left the house he had forgotten to fasten the latch and, as we entered our yard, a panther which was inside made one spring and attempted to seize me from my mother's arms. His teeth badly bit my wrists and fingers but my mother uttered such piercing screams that the men came rushing out from the mosque, rifles in hand prepared to meet raiders or an enemy. When my mother explained that it was a panther, immediate chase was given, but it was too late and the animal escaped to the hills. The scars are still on my hands, in the morning I will shew them to you.' She did.

Our hostess also told us that somewhere in the hills, in one of these caves of her childhood there lived a fierce woman who was suspected of being a man-eater. Some persons had at different times mysteriously disappeared, and there were rumours of a kind of witch or vampire woman having been seen after dark, who was out to kill and eat the unwary.

Ibn Rashid of Hail was determined to put an end to these rumours, and if there was any truth in them, he would set his guards the task of capturing this woman.

For months and months many of his mounted men were sent out by night into the hills, and surely one night the report came that the woman had been seen stealthily emerging from a certain deep cave. At once a strong guard of armed mounted men was sent to the spot and the cave duly surrounded.

As this monster creature returned to her hiding place before dawn, she was set upon and captured, bound and brought before Ibn Rashid.

She was a terrible looking woman with large head and wild tangled hair and fangs like the fangs of an animal.

She spoke in a wild language which the men could hardly understand, and confessed that on one or two occasions she had eaten human flesh and blood. She could not say where she had come from or who she was, but explained that she was half man half woman—a hermaphrodite.

Before passing the death sentence, Ibn Rashid wished for evidence of her having killed and eaten human beings, and ordered her to take his men to her hiding place in the hills. The armed guards, on reaching the outskirts of the town, killed her and buried her as *per* previous arrangement.

A VISIT TO AUHA ISLAND.

At 3.30 a.m. on Saturday morning, May 9th, I was awakened by Ibrahim calling outside my tent.

'The wind is from the west, make ready and we will go'.

By 4 a.m. we were all aboard and sailing towards Sa'ad and Sa'ida the two ancient mounds or shrines on the south-west point of Falaicha. Our journey to Auha had begun.

Auha Island is a small island with a sandy shelving beach on its north side.

It is about ten acres in size and lies off the south-east corner of Falaicha Island where there is a sand spit known as the 'Dewan'. 'Kharur Auha' is the name given to the deep channel, about one and a half miles in width, which divides Falaicha from Auha.

We reached Auha in our sailing boat—a Balam—and landed on the sandy side of the island, i.e. the northern most point at 9 a.m.

A flock of birds were sitting on the shore, and they rose as we approached. As far as I could see these were terns and gulls, though two were of a much larger type of gull, with head and wings black and a grey back. After these birds got up and gave the alarm, a large flock of about 100 Crab Plover also got up from the centre of the island, followed shortly after by another large flock. They twisted and turned once or twice before flying out to sea where they broke up into smaller packs of ten or a dozen birds each.

These small flocks returned and flew round about at intervals. Having landed on the shore we found two large eggs close together and immediately above the high water mark. They were each in a shallow depression with a few splashes of white droppings round the edge of the nest. The colour of one egg was pinky buff, streaked with bluey-grey, and blotched and dotted with dark brown to reddy-brown, measurement 2.58×1.69 . The colour of the other was creamy white with very faint blue-grey blotches and a few brown dots, lines and blotches. Measurement 2.57×1.77 .

The Arabs called them the eggs of 'Tarachi', and they probably belonged to the two large birds we had seen get up from the shore.

As we walked up on to the island and approached the brown bumpy patch which was the nesting place of the Crab Plover, single birds would come up out of the holes, run a few yards with outstretched neck, and fly off. One large white egg was lying at the entrance to one of the holes, and another, slightly broken and quite fresh some way off. The sailors then began to collect the eggs, a tiring and hot task.

The mouth of the holes was about six inches across, and it was possible for a man's arm to be put in easily. The egg lay at the far end of the burrow, which was sometimes as much as four and half feet long dug obliquely in the ground, others were slightly shorter. Every burrow did not contain an egg, but roughly one in three only. The Crab Plover's egg is very large for the size of the bird, and white. They vary slightly in size as will be seen from measurements taken,— 2.57×1.82 , 2.62×1.88 , 2.64×1.78 , 2.53×1.55 . The usual number of eggs laid was one, but *very occasionally* two were found in one burrow.

The Arab name for these birds is 'Kumairi' (pronounced Chuwairi). They say the bird does not eat fish, but lives on small worms and tiny crabs which they pick up along the shore. Hence the eggs have not a fishy taste and are much sought after by the Arabs.

I tried to shoot one of these Plover in order to identify them exactly but failed. My 16-bore cartridges were old and the heat made things difficult. I winged one bird which unfortunately fell into the sea and we could not get it. Its mate at once separated from the small pack and flew over it and around about it for some time uttering a plaintive cry, until it swam out to sea.

Ibrahim and I left the three men collecting eggs and wandered across to the south side of the island. Here we found the nests of what the Arabs call 'Zergi', 'Ab al Khasaif' and 'Sultani'. Each nest was similar, nearly flat built of dry twigs and about nine or ten inches across. They were perched on the top of low bushes of 'Hamdh' some twelve to fourteen inches from the ground. The eggs were bluey-green with an occasional splash of chalky white. In each of four nests we found one egg, with three eggs in a fifth one. One nest was placed on the top of some stones at the foot of a cairn, and another on the top of an old navigation iron post which lay on the ground, having some years previously rusted through and fallen, leaving only about ten feet of upright post standing.

Along this shore on the rocks we saw the owners of the nests, some appeared to be smallish black herons, and others pure white herons or egrets of the same size. According to Ibrahim the white ones were male and female 'Ab al Khasaif', and the blackish ones were called 'Zergi'. The ones he called 'Sultani' had a sort of crest of long feathers down the head and neck. We found one broken egg lying on the ground close to a nest, and Ibrahim said that the birds broke them on purpose if they saw a person coming.

The burrows of the Crab Plover of last year and the previous year were to be seen in two other spots on the island. Again, according to Ibrahim, each year the birds dug new burrows some little way away from the old ones. The old holes were all closed and appeared to be filled in, probably by wind and weather. No plants or bushes were growing on them, although round about were bushes of Hamdh, Tahma, (*Scrophularia*) Shinan and a *Mesembryanthemum*.

Altogether seventy-four Crab Plover eggs were collected, besides seven Zergi and the two large Gull's eggs (Tarachi).

As we moved off to the boat the small packs of Plover began to return and settle on the shore some little way away until a large flock was collected, when they ran up the beach all together, then some 100 or so in a body flew to their nests, followed by more and more.

Ibrahim described them to me as having black legs about seven inches long, body all white except for a black streak on the back of the head and neck. I noticed also that they had some dark on their wings when flying, and their legs stretched out behind them.

He said that the previous year, he and his sons had taken seven birds on their nests out of the holes. They were only about the size of a pigeon, but good eating. One bird had laid an egg after reaching his house at Maskan.

The eggs when cooked were very tasty though the white was tough. Some of the eggs collected this year were very slightly incubated.

Last year there had been many nests of Terns on the shore which he called 'Hamr Mangar' (the red beaked one) and 'Hamr Maraikh', and the 'Kuwaiti' were more numerous than this year.

We left the island at about 11-30 a.m. getting back to Maskan on a strongish south wind at 2-30 p.m.

Small black-headed Terns flew continuously round the boat diving into the sea after the small fish which scattered away from the bows. Only some dives were successful and more often the birds caught nothing. Suddenly two Terns overhead were attacked by a single larger dark speckled bird with pointed tail¹, which appeared to be endeavouring to catch and kill them. They twisted and turned screeching all the while with the larger bird after them. Suddenly the attacker seemed to take no more interest and flew quietly off low down on the water and settled some way off. Ibrahim then explained that this peculiar bird lived on the droppings of Terns. It came after them and attacked and frightened them until out of pure nervousness they did as wanted, and the larger bird caught this and ate the dropping in mid air and flew off. Although I witnessed these attacks twice it was all so quick that it was impossible to see exactly what happened. Another theory is that the Terns vomited up the small fish they had just caught and this other bird caught and devoured it in mid air.

NOTE.

On Auha Island there were many dead small birds which looked like Martins—white breast brown-grey upper parts—and a few swallows.

On Maskan Island many of the larger species of Bee-eater with orange and brown colouring were being picked up exhausted by the children. They were not nesting there.

The remains of a 'Hubara' (Lesser Bustard) and many dead martins and swallows were also lying about, obviously they had been overcome with thirst and exhaustion while migrating. I saw some small Chiff-chaffs drinking the dew from the 'Shinan' bushes in the early morning.

There was a heavy dew on each of the three nights I spent on the island. I noticed some other varieties of migrating birds passing through on their northern migration, but I was not able to identify them. Six Curlew were seen on the shore.

¹ Ibrahim said the bird had a forked tail like a swallow, but I could not determine this properly.

BIRDS' NESTS FOUND ON MASKAN ISLAND. (7-5-42).

(a) The Crested Lark, '*Goba*', were nesting. I found one small nest under a '*Hamdh*' bush with three eggs. The nest was completely made of dry '*Samaa*' grass and very neat. I also found a similar nest under a bush but very small and only about one and a half inches across, but with no eggs. The larks sang each morning and evening.

(b) The Green Bee-eater '*Kadhari*' had some fifteen to twenty nests all in burrows. One small white almost spherical egg was picked up at the entrance to one of these tiny burrows. They are dug obliquely into the ground for quite ten feet.

(c) Kentish Plover, '*Garawi*' were nesting. Their nests were usually on the dry hard patches of earth away from the shore, and were just a circular depression lined with chips of dried mud and pieces of broken sea shell. I found two nests containing three eggs and one nest with one egg. One bird was seen running ahead of us trailing her wing and taking a zigzag shoreward course. She probably had young, but I could not find them.

(d) The small Terns, '*Juwaida*' were also nesting and flew over-head screeching. One nest under a '*Hamdh*' bush contained one egg slightly more pointed than (c) above was possibly a Tern's, though the nest was similar.

KUWAIT,

VIOLET DICKSON.

PERSIAN GULF,

May 7, 1942.

VIII.—BLACK MAHSEER.

(With a plate)

With reference to your letter of the 14th January; when I originally wrote to you on the subject of Black Mahseer which led to the publication of an article in the Journal (vol. xlii, p. 804 et seq.) by Dr. Sundar Lal Hora, I did not realize the importance which was likely to be attached to photographs of these fish. I therefore only sent a picture of one caught by me. Luckily, however, I had photographed all four Black Mahseer caught by me and mentioned by Dr. Hora in his article. A photograph of one was published in his article and I now enclose those of the other three.

The 11 $\frac{3}{4}$ lb. fish caught at Ukiam on the Umkhri river in Kamrup District on the 20th December 1937 is illustrated in Plate I, Fig. 1. This fish was caught in gin clear, almost still, water and came rushing out from behind a rock to take a brass backed and silvery fronted 2 inch hog backed spoon, mounted with two flying trebles. In the photograph, the head looks something like a Boka. This is, however, due to the background and to the tension on the lower jaw by the spring balance on which the fish was being held at the time.



Fig. 1.—11 $\frac{3}{4}$ -lb. Fish, Kamrup Dist.



Fig. 2.—18-lb. Fish, Syom River.



Fig. 3.—Smallest Black Mahseer seen.

BLACK MAHSEER

Photos by author.

Plate I, Fig. 2 illustrates the 18 lb. Black Mahseer obtained on the Syom river on the 21st November 1935. The other fish in this photograph is a Boka of $5\frac{1}{2}$ lbs. caught earlier in the day on the same river. This black specimen was caught in a still backwater and, curiously enough, long after the sun had gone off the water, which was in deep shade at the time in contrast to the conditions of bright sun usually necessary to catch good fish in those waters. Plate I, fig. 3 is a photograph of the smallest Black Mahseer I have so far caught or seen. This fish was obtained at Rongdoi near the confluence of the Lohit and Brahmaputra rivers on the 29th January 1937 and was hooked in very deep water on a copper backed and silvery fronted 2 inch hogbacked spoon. Immediately to the right of the Black Mahseer is a Boka and the other two are also Mahseer, but of the usual colouration. The contrast in colour is very well illustrated between the black and the ordinary type. This black specimen was caught, incidentally, in water where the river bed consisted of light grey-coloured sand over an area of many miles and the spot was thirty miles from the point where the Brahmaputra leaves the Abor Hills for the open plains and similarly over sixty miles from where the Lohit emerges from the Mishmi Hills. So any question of protective colouration can safely be ruled out in this instance, unless the fish was migrating; but this, however, was very unlikely having regard to the date on which it was caught.

R. E. PARSONS, F.R.E.S.,

Indian Police.

SHILLONG,
ASSAM,

February 17, 1942.

IX.—BLACK MAHSEER.

Owing to destruction by white-ants of most of my fishing diaries while on leave in 1939, I am afraid that I have very few original records to which I can refer but speaking from memory, I cannot think of any occasion upon which I have caught a black mahseer and in fact, the suggestion is strange to me.

I have, however, fished extensively in certain rivers which flow through limestone formations. In such rivers, as is well known, you get extremely deep pools and clefts which very frequently harbour big fish. In such rivers I have often seen, what I took to be, extremely dark if not black fish, and on quite a number of occasions, I have seen such fish break the surface of the water, either because they came up from the depths to seize something or because they were in shallows. In fact I can remember on one occasion when a fish about 14 lbs. in weight was hiding behind a stone and plunging out in pursuit of food. Every time he came out I could see a big black back. I caught him by trickling the spoon past the rock and after a long fight I got him out; but when I got him in the sunlight he was not black but a very dark blue.

For five years I fished in the upper waters of the Yunzalin River where the fish were all dark blue in colour. Many of these from the upper waters were so dark that until you had them in the bright sunlight you would have said they were black but the fact remains that, taken out of water, they were all seen to be various shades of blue. My impression is that as we got higher up among the limestone gorges the fish became darker and darker and even the fins themselves were deep blue. In no instance did I ever come across a really black mahseer. As I have said, in the water the fish do look black. When taken out of water, if seen in a poor light, they would also be black but seen in strong sunlight, the blue colour shows up very prominently. In these fish too, the belly was extremely white. The fins were dark blue sometimes and at other times, only a powder blue.

I am afraid that, although I have spent nearly 30 years fishing all over Burma, I cannot throw any particular light on this problem. As a personal opinion I should say that the black mahseer is a case of melanism pure and simple. The examples I have quoted from the limestone rivers seem to show that where you got fish from these high narrow gorges of the water to which the sun can only penetrate for a very few hours out of the 24, the fish are naturally very dark in colour; but I have certainly never experienced anything in the nature of definite black strains among mahseer; whenever I have taken these dark fish out of water and examined them in the sunlight I have always found that they were really blue in colour, I am inclined to be a little sceptical about the existence of black mahseer. I suppose that one would be liable to get examples here and there, but anything in the nature of a wholly black mahseer, I have never found or even heard of.

I note the description of black mahseer says that it has little white belly scales. This was never the case with any of the dark blue fish from the limestone gorges. The whole of the belly was absolutely white, and I can recollect no occasion upon which the colour was blue all over. I feel sure that if I had ever come across such a fish I should have remembered such an unusual departure from the normal. I may add that my record shows that I caught several hundreds of fish every year from the upper reaches of the Yunzalin River and I was on it for 5 years; so I saw a good many blue fish.

RANGOON,

M. O. TANNER, O.B.E.,

September 1941.

D.I.G. of Police.

X.—CAN HILSA BE TAKEN WITH ROD AND LINE?

As is well known the Hilsa (*Hilsa ilisha* Ham.) which are marketed all over Bengal and Assam are caught in nets of a somewhat curious shape and *modus operandi*. While watching fishermen at work with these nets I have often wondered if it is possible to catch this fish with a rod and line, since a Hilsa straight from the river into frying pan is hard to beat. Can you let me have any information as to

whether it can be caught on a rod, please, and if so with what bait?

SHILLONG,

R. E. PARSONS, F.R.E.S.,

ASSAM,

Indian Police.

February 3, 1942.

XI.—ACCLIMATIZATION OF FOREIGN FISH IN TRAVANCORE.

All through the history of civilisation we find mention of Game fishing. This form of fishing was common even at the time of the ancient Greeks and Romans and is mentioned in many of their writings. Fishes for game purposes have been introduced in all countries at all times in history, and in more recent years with the application of Science to fisheries and their developments, they have been introduced for commercial and other divers purposes. The earliest and probably the first acclimatization ever recorded was that effected by the Romans at the time of Emperor Tiberius, when *Scarus* from the Carpathian Sea was introduced into the Ostian and Campanian shores.¹

As early as the eleventh century Carp from Central Asia was introduced and acclimatized in European countries,² and by the middle of the nineteenth century acclimatization had become a common thing in all countries of the world. At one time it was held that introduction of exotic fish into countries was harmful to the indigenous species. Years of experience gained in all parts of the world have proved otherwise. Even inter-zonary acclimatizations have been carried out with remarkable success. A well known instance of acclimatization is the introduction of European and American Salmonidae into New Zealand in the year 1864.³ This country, in spite of its unique flora and fauna and also its magnificent system of water ways, had no indigenous fish of commercial or sporting importance. But now certain rivers and streams there teem with trout. American fishes have been introduced into the Argentine Republic (1904) and then in European countries like Italy and Austria,⁴ and even in the United Kingdom. Gourami, a native fish of the Malay Archipelago, was introduced into many countries such as Mauritius, Cayenne, Australia (1864), the

¹ Radcliffe, W. (1926)—'Fishing from the Earliest Times', pp. 159-61. (London, 1926).

² Chambers, W. O. (1883)—*The Fisheries Exhibition Literature*, vol. xi, part iv, pp. 489-97.

³ Ayson, L. F. (1908)—*Bull. of the U. S. Bureau of Fisheries*, vol. xxviii, part ii, pp. 968-73.

⁴ Ayson, L. F. (1908)—*Bull. of the U. S. Bureau of Fisheries*, vol. xxviii, part ii, pp. 949-54.

Philippines (1927) and Ceylon (1908).¹ These are but a few of the well known instances from other parts of the world. In India, too, instances of such introduction are not wanting. Brown trout and rainbow trout were introduced in the rivers of Punjab (1909)² and in the Nilghiris in Madras (1866).³ Gourami from the Malay Archipelago, and *Gambusia*, a species of Top Minnow from America, have also been introduced in different parts of India. Attempts at the introduction of 'Barbados Millions', however, have not been successful.⁴

In Travancore, the importance of game fishing was realised only by a small percentage of the population, namely Europeans, mostly resident planters of the high range hills. The Department of Fisheries, which had until recently been a purely administrative body was amalgamated with the recent scientific research section only a couple of years ago. Consequently, all attempts at acclimatization hitherto have been undertaken by other agencies such as the Munnar Game Association and the Department of Public Health. The resident planters of the State took the initiative by introducing trout into the country and their attempts are still being continued with vigour. Their enterprise has cost a good amount of money and all the necessary funds have been raised through private donations.

TROUT.

Acclimatization of foreign fish in this State dates back to 1906, when the introduction of Trout was first attempted by the Munnar Game Association. The Kannan Devan Hills, at the north-eastern extremity of Travancore, having an altitude ranging for 4000 to 8000 feet above sea level and forming a part of the main chain of the Western Ghats, were selected for this purpose. This part of the country lies roughly between 77° and 77° 20' East Longitude and 9° 55' and 10° 20' North Latitude and is absolutely mountainous and covered over with evergreen forests and mountain slopes converted into extensive Tea Plantations. Its numerous valleys are strewn with small rivers, streams, waterfalls and lakes which are fed by the heavy annual rainfall ranging from 113 to 153 inches.

Between 1906 and 1916, eggs of Brown Trout (*Salmo fario*) were brought down four or five times from Scotland at great cost, hatched out at Chundavurrai and planted in the rivers and streams of Kundale Valley (6118 ft.) and Nymakad (6043 ft.)

¹ Roxas, H. A. and Umali, A. F. (1937)—*The Philippine Journal of Science*, vol. 63, No. 4, pp. 433-82.

² 'Report on the Trout cultural operations in the Punjab and Native States under its control for the period Oct. 1912 to March 1914.' (Lahore, 1914.)

³ Molesworth and Bryant, J. F.—*Journ. of Bombay Nat. Hist. Soc.*, vol. xxvii, pp. 898-910.

⁴ Prashad B. and Hora, S. L. (1936)—*Records of the Malarial Survey of India*, 6, iv, pp. 631-48.

within the Kannan Devan Hill Concessions. In 1916, eggs of Rainbow Trout (*Salmo irideus*) were obtained from the Government hatchery at Ooty, through the late Mr. H. C. Wilson, Piscicultural Expert to the Government of Madras and planted in the above streams. Brown Trout were found to thrive with great difficulty and specimens weighing upto six pounds have been taken from Munnar stream and the Eraviculam stream in Hamilton's Plateau (Eravimala).¹ This latter place which is at an altitude of about 7800 feet above sea level and has a very low temperature proved a suitable breeding place for this fish, and in 1918 some of them were observed to breed.

In order to protect the fish in the above areas from poachers and other destructive agencies, the Travancore Government at the request of the High Range Angling Association, closed in 1921, all the streams and lakes within the limits of the aforesaid Concessions for fishing at all times of the year except under a licence issued by the Commissioner of Deviculam in consultation with the Secretary of the said Angling Association.

The attempts at acclimatization of trout between 1906 and 1916 were, however failures, and between the years 1921 and 1932 there was a lull in the attempts. In 1932 on the initiative of some of the planters, a few hundred Rainbow trout fry were successfully brought by lorry from the Avalanche hatchery in the Nilghiris and liberated in a number of sluggish ponds at Chittavurrai (7096 ft.). Though these ponds served as temporary abodes for these fish, they proved in the long run to be quite unsuitable, owing to the lack of clear running water and enough moving space. The fry showed a tendency to abnormal increase in weight and after the first year ceased rising to the fly and subsequently died. Thus these attempts also proved futile.

In 1933, a hatchery was constructed at Arivikad (6057 ft.), and between 1933 and 1937, the Deviculam lake and the Loch Finlay were repeatedly stocked with trout fry. In the former lake the introduction proved quite a success although there was no evidence of the trout breeding during that period. Several good catches of fish were recorded, the heaviest taken being about 4 lbs. in weight. Unfortunately, owing to unsuitable location the hatchery proved a failure in spite of the earnest efforts of the authorities concerned to resuscitate it, and was subsequently closed down in 1937. The stock fish in the hatchery ponds, about 170 in number, were liberated in the streams of Hamilton's Plateau, which had by then been definitely proved to be an ideal home for these fish.

In December 1940, definite proof of the breeding of trout in the waters of Hamilton's Plateau was obtained. As it was thought that further stocking was necessary, 10,000 eggs (Rainbow trout) were purchased from the hatchery at Nuwara Eliya in Ceylon and were brought by 'plane to Trichinopoly and thence

¹ There are conflicting views about this in the reports of the Hon. Secretaries of the High Range Angling Association then and now.

by car to Thaliar. From the latter place the chest containing the ova was brought in slow stages to Hamilton's Plateau, where the ova were hatched out by the 'riverbox' method, and the 5,000 fry thus obtained planted in the waters of the Plateau. At present there is ample evidence to show that a majority of these have come through to maturity. Again in January 1941, a second consignment of 5,000 eggs of the same fish was brought by 'plane' from Ceylon. But this time many delays and difficulties in transport resulted in a high percentage of mortality. Nevertheless, the rest of the lot was hatched out by the same method at Rajamallay (7738 ft.), and the 1,300 fry obtained were planted at Devikulam and Chittavurrai. A hatchery which has now been completed (Nov. 1941) at Rajamallay will begin to function as soon as the ova ordered from Ceylon have been received.

Trout acclimatization in Travancore is still in an experimental stage and may take some more years before it reaches perfection. However, the results of past experiments have been encouraging, and the Associations concerned in this enterprise are optimistic about their success in the near future. Based on the results of 'plants' of fry made in the past couple of years, it is anticipated that in 1943 the High Range Angling Association will be in a position to take ova from its own stock of fish, with the result that future importations will decrease.

TOP-MINNOW.

In 1937, the Department of Public Health introduced into this country, a species of American Top-Minnow, named *Gambusia affinis* (Baird and Girard) for malaria control work. This small viviparous, cyprinodont fish is a native of the south-eastern Atlantic coast of the United States of America, extending as far north as Maryland, and is usually found in great numbers in the shallow margins of lakes, ponds and streams in the tide water regions, where there is aquatic or semi-aquatic vegetation, and also in shallow ditches and surface drains. On account of its high efficiency as a destroyer of mosquito larvae thereby controlling malaria and yellow fever, it has been introduced into many parts of the world. In this State, this fish was introduced from Mysore, where it was brought from Italy in 1928 by Dr. B. A. Rao.

The first consignment of *Gambusia* was brought to Travancore in February 1937, but due to the sudden change of temperature and the imperfect transport arrangements, most of these died soon after arrival here. Only about hundred and fifty specimens survived. About 600 to 800 fish, which were brought with more care a second time in July 1938, were introduced into the rearing ponds of a hatchery constructed at Perungadavila, an important malarial centre, three miles away from the town of Neyyattinkara. They have happily acclimatized themselves to the climatic and other conditions in this country and are at present thriving well in three specially constructed rearing ponds at the above mentioned place. The District Health Unit at Neyyattinkara was experimenting on the efficiency of this fish as a destroyer of Anopheline

larvae under local conditions, and finding its utility in limited bodies of water free from vegetation, has stocked all the wells in the malarial districts with a limited number of fish. The Health Unit is contemplating the extension of this scheme to other malarial centres as well.

GOURAMI.

The Department of Marine Biology and Fisheries has now undertaken to introduce the Giant Gourami, (*Osphronemus gourami* Lacépède), into the State, and the preliminary arrangements such as the construction of the pond system, etc., are in progress. It is proposed at present only to experiment on the possibilities of acclimatizing the fish over here, and later on the basis of these experiments it is proposed to launch out a commercial project. This fish, as mentioned in an earlier part of this note, is a native of the Malay Archipelago and is essentially vegetarian and therefore neither predaceous nor cannibalistic. Being a labyrinthine fish, it is able to carry on aerial respiration as well as to resist considerable pollution of water. On account of such simple habits and extreme adaptability, it has earned the name of 'poor man's fish'. It was introduced into Madras in 1886 and there is no reason why it should not be a success here too. Dr. A. W. C. T. Herre, of Stanford University, California, who had done a lot of work on this particular fish, was on a visit to this country in January 1941, and when consulted on this subject remarked that the topographical and meteorological conditions of this country being almost identical with that of the Philippines; acclimatization of Gourami is bound to be a success. If this proves correct, it may enable us, to a considerable extent, to make such a cheap and nutritious article of food as fish, accessible even to the poor living in the interior of the country.

In concluding, I have to express my deep indebtedness to Mr. E. H. Francis of the Kannan Devan Hills Produce Ltd., and to Mr. W. S. S. Mackay, Hon. Secretary of the High Range Angling Association for kindly placing at my disposal some valuable data regarding trout in the High Range, and also to Dr. C. C. John, Professor of Marine Biology and Fisheries for kindly going through the manuscript of this note and making necessary corrections.

UNIVERSITY OF TRAVANCORE, R. GOPINATH, B.A., M.SC.

TRIVANDRUM,

TRAVANCORE,

February 20, 1942.

XII.—ON THE ROLE OF *ETROPLUS SURATENSIS* (BLOCH) AND *ETROPLUS MACULATUS* (BLOCH) IN THE CONTROL OF MOSQUITOES.

The use of fishes in the control of mosquitoes varies according to their feeding habits. Certain herbivorous species are helpful in

clearing the weeds from the water thus making the place less suitable for the breeding of mosquitoes, while some carnivorous fishes destroy the larvae by preying upon them. Stomach contents of several fishes, which are considered as larvicidal, have often shown only very low percentage of mosquito larvae. Such instances have led different authors to doubt the use of fishes in the biological control of mosquitoes. It is, however, not enough if attention is paid only to the amount of larvae that a fish eats, as certain fishes with snapping habits are also helpful in destroying larvae though they may not leave any evidence in their gut of their larvicidal activity.

Most fishes snap at objects of suitable size, possibly to test their edibility. Those not to the taste of the fish are spat out. Certain fishes, whether carnivorous or not, have a tendency to snap at any moving object whether worm, insect larva, or even a floating fibre. When they see anything moving near, they snap at it, take it into the mouth and spit it out, doing this several times before they finally swallow the object or discard it. Perhaps this is done to discover whether the object snapped at is edible or not and, if edible, to ensure thorough killing before it is finally swallowed. This treatment no living larva could survive.

I can illustrate this from observations made on *Etroplus suratensis* and *Etroplus maculatus*.

The Irwin Park, Ernakulam (Capital of Cochin State), is situated on the eastern shore of the Cochin Backwaters facing the harbour. At the southern end of this park there are two lotus ponds. Each has a diameter of about 20 feet and a depth of 6 feet, and their sides are plastered with cement. Both ponds are always full of water, although in the very hot months the water level goes down sometimes to half its depth. In one of these ponds the gardener had put in two *Etroplus suratensis*, which grew to a size of about 7 inches from snout to tail. These fishes were a special attraction to the visitors in the park because they were so tame that they came near anybody who made a splash in the water. They showed no signs of fear and snapped at everything that was thrown in the water, such as petals of flowers, grass blades, paper pieces etc. Several people had the nasty habit of spitting into the water, especially when chewing *pansupari*, and the fishes snapped at the objects that were spat in. They also snapped at one's fingers if dipped in the water, and it was possible to lift them partly above the surface if the finger was raised just at the time of snapping! In the evenings the pond was surrounded by people, and it was really interesting to see fishes as familiar with visitors as monkeys and deer in a zoo.

This was an observation I was able to make in 1938. Since then the fishes have disappeared from the pond for reasons unknown. Perhaps, they may have been carried away by somebody, or have died in the hot months for want of adequate protection from the sun. There is also the possibility of premature death, as the people who played with the fishes may have worried them too much.

From the behaviour described above, it is evident, that *E. suratensis* will not spare mosquito larvae appearing before them.

As it required elaborate arrangements to conduct further experiments on *E. suratensis*, I selected *E. maculatus* for the purpose, because it is small in size and very commonly met with along the shores of the brackish water areas. Even though this is a carnivorous fish, mosquito larvae do not form an important constituent of its diet. During low tide *E. maculatus* gets temporarily confined to pools of water in the small canals adjoining the mudbanks of brackish water regions. Into such a pool, a fingerbowl of water containing mosquito larvae was thrown in and carefully watched. As the larvae wriggled up and down, the fishes became very active and began to prey upon them, even though the prey was snapped at and thrown out several times before actual swallowing was done. Some larvae went down to the bottom without any movement which was proof enough to show that snapping had the effect of killing.

These observations go to prove that in judging the larvicidal value of fishes, their snapping propensities should also receive due consideration, this would throw new light on the utility of many larvicidal fishes, whose stomach contents show only stray cases of mosquito larvae, and which now appear seemingly unimportant. Hence, when mosquitocidal fishes are classified broadly as predatory, carnivorous, herbivorous etc., it is necessary to include those with pronounced snapping habits.

There are about twenty *E. suratensis* now growing in another tank situated in the centre of the Irwin Park, Ernakulam. This tank is bigger and deeper with a 2-feet-high masonry wall built around, so that people have not the chance of touching the water. These fishes are each about five inches long, and very active in snapping at objects falling into the water. Visitors to the park have their usual pastime of throwing in leaves, petals, etc., and it is interesting to see several of the fishes struggling at one spot to snap at any object thrown in.

V. O. SEBASTIAN, M.Sc.

MADRAS,

March 14, 1942.

XIII.—STAG BEETLES (*LUCANUS LUNIFER*) IN COMBAT.

I was walking along a hill path about 10 a.m. one morning and as I was passing under an oak tree I heard a loud and irregular sort of clicking noise. I looked up and located the sound and found it came from two male stag beetles, which were locked together in fierce combat on the moss, on the underside of a branch about 12 to 14 feet from the ground. I watched them for some minutes and found the loud clicking noise was due to their efforts to get a better and more powerful grip on each other with their jaws. Eventually I knocked them off the branch with a long stick on to the ground. When I went to pick them up I found a third beetle, obviously a female of the same species, had fallen off the branch along with the two males, although I had not perceived her presence until then, as she must have been hidden in the moss. I can think of no other

supposition than that they were fighting over the lady. Have these stag beetles been known to fight over the female before? Another minor point is that these beetles, judging by their eyes are obviously nocturnal, yet these two were fighting lustily at 10 a.m. in the morning, although I must admit the weather was very dull and overcast at the time following heavy rain fall—Altitude about 6,000 feet.

GONDA, U. P.,
September 30, 1941.

W. A. HEWITT,
Dist. Traffic Supdt.,
B. & N. W. Rly.

XIV.—EXTENSION OF THE RANGE OF THE ATLAS BEETLE (*CHALCOSOMA ATLAS*).

I picked up the enclosed remains of a beetle shortly before last Christmas on a forest path in the Chittagong Hill Tracts, close to the Arakan border. Ants had already completed its dissection into the three separate pieces comprising the head and horn, thorax, and body, as you now find them and were finishing off the cleaning out process. As it is the biggest and most curious beetle I've so far seen, I would like to know something about it. If it happens to be somewhat rare, it may be of use to you for the Museum.

AHMEDABAD,
May 24, 1942.

R. S. P. BATES,
Lt.-Col.

[The beetle sent by the writer is the great Atlas Beetle (*Chalcosoma atlas*). It is perhaps the largest insect found in the Oriental Region. Its occurrence in the forests of Chittagong, is an extension of its known range which is recorded as Nepal, Burma, Arrakan and the Malay Peninsula.—Eds.]

XV.—ON THE ANATOMY OF SOME OF THE URTICACEAE.

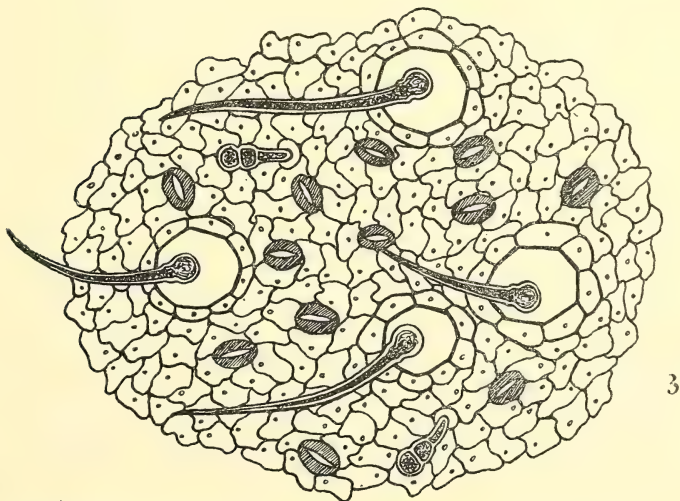
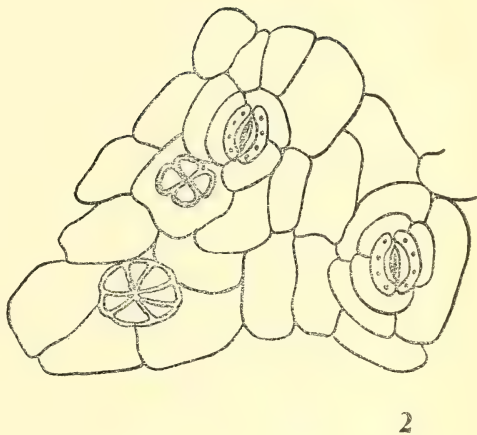
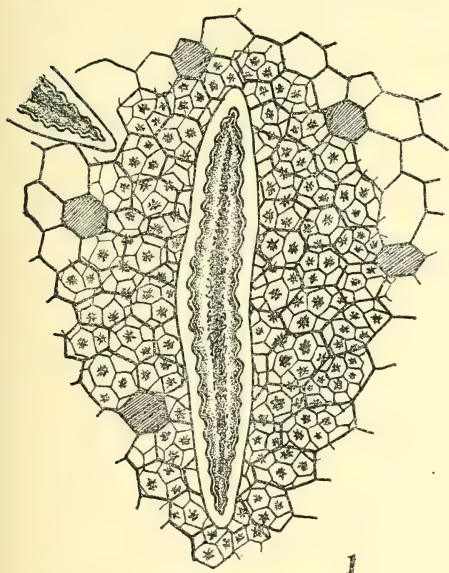
(With one plate).

Very little work has been done on the vegetative anatomy of the Urticaceae in India. The following plants were, therefore, taken up for anatomical investigation:—

Pilea microphylla Leimb., *Pellionia Daveauana* Br. and *Holoptelea integrifolia* Planch.

Stomatal apparatus. In *Pilea* and *Pellionia* stomata are accompanied by three subsidiary cells, whereas in *Holoptelea* stomata are surrounded by ordinary epidermal cells (Fig. 2), thus showing that there is no uniform type of stomatal apparatus.

Leaf structure:—Two of the plants *Pilea* and *Pellionia* are succulent herbs and contain water storing cells of great height and wide lumina. It is the lower epidermis in *Pilea* that serves this purpose. There is nothing striking in the leaf of *Holoptelea* which is bifacial, and stomata occur in greater abundance on the lower than on the upper surface.



Sayeedud-Din.—On the Anatomy of some of the Urticaceae.

(For explanation see end of note.)

Cystoliths :—Ellipsoidal cystoliths occur in the leaf in *Pilea* and *Pellionia*. In the epidermis of the leaf of *Pellionia*, cystoliths are visible to the naked eye like small linear markings. Besides these, clustered crystals of calcium oxalate are also found in the mid-rib of the leaf and stem (Fig. 1). In *Holoptelea* cystoliths do not occur. Clustered crystals of calcium oxalate are, however, present in large numbers.

Hairy-covering :—*Pilea* and *Pellionia* do not possess any covering. There are peltate glands present in *Pellionia* (Fig. 2). They are divided into 4 or more cells. *Holoptelea*, however, possesses long simple tapering unicellular hairs, and glandular hairs. The latter consist of a unicellular stalk and a head composed of two cells (Fig. 3). Although there are no glandular hairs in *Pilea*, there are some secretory canals present from which exudes a sticky secretion (probably mucilage). The exact nature of the contents of these cells is, however, not yet investigated.

Structure of the stem :—In *Pilea* and *Pellionia* the cortex consists of thin-walled parenchymatous cells. Poor development of xylem at four corners, broad medullary rays and cells with sticky contents are present in *Pilea*. In *Pellionia* also xylem is poorly developed and the vascular bundles are centrally situated, leaving a wide cortical region. Medullary rays are narrow. In *Holoptelea* the primary cortex consists of collenchymatous cells. The cork is developed sub-epidermally and large lenticels are present. The pericycle contains more or less continuous groups of stone-cells. Medullary rays are narrow.

Conclusions :—Although no general conclusions can be drawn from the study of only a few genera and species, the plants investigated reveal that in contrast to the Moraceae, the Urticaceae are characterized by the absence of laticiferous tubes and the frequent presence of cystoliths. This supplements the results obtained by foreign investigators in other genera and species. The stomata possess three subsidiary cells in *Pilea* and *Pellionia*. The hairy covering consists of simple unicellular hairs, and small glandular hairs. *Pellionia* contains small peltate glands which secrete a mucilaginous substance, and *Pilea* contains secretory canals. The cystoliths are ellipsoidal in form in *Pilea* and *Pellionia*. Besides these, clustered crystals of oxalate of lime occur in *Pellionia* and *Holoptelea*. There is nothing noteworthy about the structure of the stem. These observations on the whole conform to those recorded by Solereder (1) for other genera and species.

As this article was going to the press, the paper 'The anatomy of *Cannabis* and *Corchorus*' by Dr. B. C. Kundu (2) appeared in the *Journal* of the Indian Botanical Society. As has been stated above very little work has been done on the Indian species of Urticaceae, including the Moraceae. Hence the anatomy of *Cannabis* is a welcome addition to our knowledge.

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1. Solereder, H. (1908).—Systematic Anatomy of the Dicotyledons, Engl. Ed. II, pp. 770-78, and p. 1063.
2. Kundu, Balai Chand (1942); The anatomy of two Indian fibre plants,

Cannabis and *Corchorus*, with special reference to fibre distribution and development. Jour. Ind. Bot. Soc., vol. xxi, Nos. 1 and 2, pp. 93-128.

EXPLANATION OF PLATE.

- Fig. 1. *Pellionia*—leaf-epidermis (upper), showing ellipsoidal cystoliths. $\times 30$.
 Fig. 2. *Pellionia*—leaf-epidermis (lower), showing stomata and peltate glands. $\times 30$.
 Fig. 3. *Holoptelea*—leaf-epidermis, showing stomata, ordinary and glandular hairs.

DEPARTMENT OF BOTANY,
 OSMANIA UNIVERSITY,
 HYDERABAD DECCAN.

M. SAYEEDUD-DIN,
 M. ABDUS SALAM.

March 1942.

XVI.—A NOTE ON THE EPIPHYTISM IN *HEPTAPLEURUM VENULOSUM* SEEM.

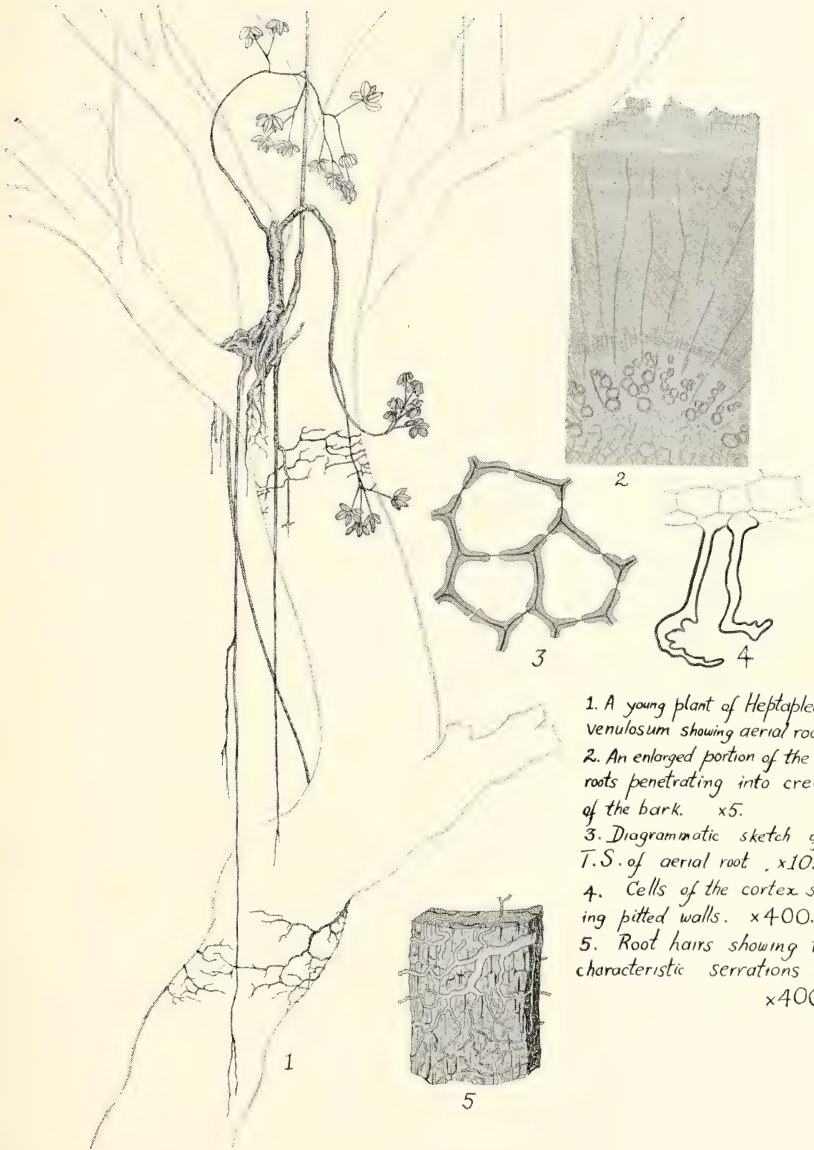
(With one plate)

In the course of the studies of the flowering plants of the Nandi Hills, Mysore State, some interesting cases of *Heptapleurum venulosum* Seem., (*Schefflera venulosa* Harms.) growing as epiphytes on other trees were noticed. A short account of the morphological and anatomical studies undertaken to throw some light on the adaptations to the epiphytic habit is presented here.

Heptapleurum venulosum Seem., is a member of the Araliaceae. In habit it is a straggling climber in the early stages, attaining later the size of a small tree. Gamble (1916) states that it is sometimes epiphytic. The plant grows in a wild state on the fort walls in Nandi Hills. In the particular instance where it was found epiphytic (Fig. 1) the plant was growing on the branch of *Eugenia jambolana* at nearly 30-35 ft., above the level of the ground. The plant was closely adpressed to the host by a large number of aerial roots. In addition, long pendant aerial roots, measuring 10-15 ft., were profusely developed. Wherever these aerial roots came in contact with the bark of the host large numbers of branches were formed and these entered the crevices of the corrugated surface of the bark (Fig. 5).

Anatomy of the aerial roots showed a large cortex and a central stele with exarch radial bundles (Fig. 2). The mature root was protected by several lamellated layers of cork cells possibly to prevent desiccation. The cells of the cortex in the young roots are in a collapsed state in dry weather, but straighten up whenever provided with moisture, simulating the bellowing action of the epidermal cells in some xerophytes. The inner cells of the cortex are thick-walled, the walls being perforated by simple pits (Fig. 3). This helps in the translocation of water in the radial direction.

The portions of the root ramifying in the crevices of the bark were carefully teased out and sections of 8 to 10 thickness were taken. The young root has a piliferous layer from which the root hairs develop. Unlike normal root hairs, they are thick-walled and



1. A young plant of *Heptapleurum venulosum* showing aerial roots.
2. An enlarged portion of the aerial roots penetrating into crevices of the bark. x5.
3. Diagrammatic sketch of a T.S. of aerial root, x10.
4. Cells of the cortex showing pitted walls. x400.
5. Root hairs showing the characteristic serrations x400.

Heptapleurum venulosum Seem.

develop a serrated contour (Fig. 4); they help in anchoring the plant to the host. They absorb the moisture collected in the crevices of the bark during the rainy season.

Many of the young plants growing on the rocky surfaces and fort walls in that area showed a similar type of development, with this difference, that they became independently rooted plants in a shorter time. *Heptapleurum venulosum* is a hemi-epiphyte as is the case with *Ficus bengalensis* (Schimper 1903). The plants are epiphytic only in the juvenile stages, later on becoming independently rooted. In this category of hemi-epiphytes Schimper (1903) includes many of the arborescent types like *Clusia*, *Carludovica*, and others.

In conclusion the writers wish to acknowledge their indebtedness to Dr. M. A. Sampathkumaran, and Dr. L. N. Rao, Central College, Bangalore, for guidance and encouragement.

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2. Schimper, A. F. W., 1903—Plant Geography, pp. 320-22.

CENTRAL COLLEGE,
BANGALORE,
May 25, 1942.

M. J. THIRUMALACHAR,
B. G. L. SWAMY,
K. B. A. KHAN.

PROCEEDINGS OF THE ANNUAL GENERAL MEETING OF THE BOMBAY NATURAL HISTORY SOCIETY.

The Annual General Meeting of the Members of the Bombay Natural History Society was held on Wednesday evening, the 22nd July 1942 at 6 p.m. at the B.E.S.T. Lecture Hall, Electric House, Fort, Bombay. Mr. J. B. Greaves, C.B.E., M.L.A., J.P. presiding.

AGENDA.

1. Reading of the Annual Report of the Committee.
2. Presentation of the Balance Sheet and Statement of Accounts for the past year.
3. Election of the Committee.
4. Such other business as may be properly brought before the Meeting.

The Honorary Secretary announced the election of 51 new members since the last meeting held on 25th June 1941.

Mr. J. George, Bombay; Mr. Frank Nicholls, Assam; The Superintendent of Fisheries, Hyderabad, Deccan; H. E. the Governor of Orissa, Orissa; Mr. P. S. Leathart, Dehra Dun; The Curator, Lord Reay Industrial Museum, Poona; Mrs. J. P. Bazalgette, Kolhapur; Mr. S. Moles, I.C.S., Pindigheb; The Asst. Commandant, Officers Training School, Bangalore; The Commandant, Officers Training School, Belgaum; Major A. G. Wheeler, Alwar; Mr. E. Powing Walsh, Kirkee; Miss K. H. Gulshaw, Medak, Nizam's Dominions; The Commandant, Officers Training School, Mhow; Mr. E. B. Wikramanayake, Ceylon; Mian Saheb Sayed Jawad Ali Shah, Gorakhpur; Mr. N. F. Frome, Nagpur; Mr. Habib S. Tyabji, Bombay; The Commandant, Indian Military Academy, Dehra Dun; Mrs. B. W. Tate, Delhi; Mr. F. C. D. Ogden, Bombay; Capt. A. P. Smith, R.E., Poona; The Commandant, K.G.V.S.O., Bengal S. & M., Roorkee; Mr. James C. Brindley, Chauk, Burma; The Senior Conservator of Forests, Bengal, Darjeeling; Major G. M. K. Young, Fatehgarh; Dr. H. C. Aldrich, M.D., Nadiad; Mr. P. M. Ismail, I.C.S., Simla; Mr. T. W. Burdon, I.P., Phillaur; Capt. R. K. Saker, Gyantse; Major R. L. Simpson, Ferozepore; Mrs. A. B. B. Moore, Aurangabad; Mrs. M. A. Hughes, Kalimpong; Mr. K. S. Bane Singhji, M.A., Wadhwan; Mr. D. G. Smyth-Osborne, Darjeeling; Mrs. J. W. Rowlins, New Delhi; The Principal, St. Mary's Training College, Poona; Mr. H. G. Seward, I.P., Allahabad; Lt.-Col. J. H. L. Hindmarsh, Poona; Mr. A. A. Macdonald, I.C.S., Lahore; Lt. C. R. Patterson, R.A., Ambala; Mr. J. Barling Fisher, Bar-at-Law, F.R.G.S., Tellicherry; Major Bruce Abbott, I.E., Roorkee; Capt. T. A. W. Davis, R.A.S.C., Jullundur; Major J. A. L. Cowie, R.I.A.S.C., Bombay; The Secretary, Taronga Zoological Park Trust, Sydney; Lt.-Col. G. A. Bridge, R.A.M.C., Murree; Mr. H. W. Witt, Karachi; Mr. T. K. Mirchandani, Dharwar; The Principal, Jat. V. Inter. Agricultural College, Meerut; Mr. L. W. Slade, Bombay; Mr. A. P. Benthall, Calcutta; Miss Margaret Douglas, Jalna, Deccan; Mr. F. H. V. Scrimgeour, Cawnpore; Major Rajkumar C. Desaraj Urs, Bangalore; Mr. George Douglas Clark, Bengal.

OFFICE BEARERS—1942.

The following gentlemen were elected to serve on the Managing Committee:—
President.—H. E. Sir Roger Lumley, G.C.I.E., D.L.

Vice-Presidents.—Rev. Father J. F. Caius, S.J., F.L.S., and Rt. Revd. R. D. Acland, M.A.

Executive Committee.—Mr. Humayun Abdulali; Mr. Farrokh E. Bharucha; Mr. A. Forrington; Mr. J. B. Greaves, C.B.E., M.L.A., J.P.; Mr. M. J. Hackney; Mr. R. E. Hawkins; Mr. D. G. Hill, F.R.G.S., J.P.; Dr. M. Sharif, D.Sc., Ph.D., F.N.I.; Lt.-Col. S. S. Sokhey, I.M.S.; Mr. F. Wadia; Mr. T. E. Savaides (*Honorary Treasurer*) and Rev. Fr. J. F. Caius, S.J., F.L.S. (*Honorary Secretary*).

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Staff.—S. H. Prater, M.L.A., J.P., C.M.Z.S. (*Curator*) and C. McCann, F.L.S. (*Assistant Curator*).

Proceedings concluded with an interesting cinema show of 'Nature Films', some in colour taken in India, with the kind co-operation of the Amateur Cine Society of India.

ANNUAL REPORT OF THE BOMBAY NATURAL HISTORY SOCIETY FOR THE YEAR ENDING 31ST DECEMBER, 1941.

ADMINISTRATION.

President.—H. E. Sir Roger Lumley, G.C.I.E., D.L.

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THE HONORARY SECRETARY'S REPORT FOR THE YEAR 1941.

THE SOCIETY'S JOURNAL.

The forty-second Volume of the Society's Journal was completed during the year.

MAMMALS.

Mr. Theodore Hubback contributed an interesting article on the Malayan Elephant. Lydekker regarded the Malayan elephant as a distinct race of the typical form inhabiting India. He sought to provide a basis for such distinction in the shape of the ear and in the

generally hairy condition of the young, whence he gave the name *hirsutus* to his Malayan race. Hubback considers that these points of distinction have little application. Baby Malayan elephants are not particularly hairy, while the shape of the ear in these animals is ordinarily not different from that of the Indian elephant. Mr. F. N. Chasen (Handlist of Malayasian Mammals) also disagrees with Lydekker's deductions and finds, between the elephants of India and Malaya, no points of distinction which could be used to differentiate them racially. Mr. Hubback discusses the distribution of the elephant in Malaya, and describes its habits and the conditions under which it lives, illustrating his notes with many beautiful photographs from his camera. The blight of war has settled upon these scenes, which the author knew and loved so well, and from which he gave us so many fine pictures and pen portraits. All his life, Mr. Hubback struggled to secure sanctuary and protection for the wild life of Malaya. His report of the Wild Life Commission of Malaya, of which he was chairman, is one of the most outstanding documents bearing on the whole problem. Alas, for his hopes and plans; they have vanished, with many others, in the cataclysm of destruction which has since befallen. We have not heard from the author for many months. We offer him our thanks for his many interesting contributions to our *Journal*, and for his generosity in providing for the publication of the many beautiful pictures which accompanied his articles. Wherever he be, we wish him well.

Mr. McCann continues his observations on the Flying Fox. He has something new to reveal about these interesting, if not very attractive, creatures. Readers will remember the author's discovery that these great bats, live entirely on the juice of the fruits which they eat, discarding the masticated pulp. He now reveals that the claws of newly-born flying foxes, are provided with fine, pointed cusps, which disappear with growth; their purpose is to enable the baby bat to secure a firmer hold on the body of the mother. To the food plants of the flying fox, the author now adds the flowers of the mango and the cashewnut tree, both profuse in the exudation of nectar. Nectar given out by the flowers of the mango, may in fact be so profuse, that it drips on to the leaves and branches, giving rise to the development of a 'black' fungus, which wilts the flowers and frequently destroys the promise of a bumper crop. The bats probably assist in the spread of the disease by carrying the fungus from tree to tree.

BIRDS.

Mr. Sálím Ali's report on the Birds of Bahawalpur, contains the results of a survey of the State carried out with the assistance of H. H. the Nawab's Government in 1939. Irrigation has converted much of the arid terrain of Bahawalpur, into fertile cultivated land, now in process of colonisation by plants and animals. The study

of the bird life of this area provides interesting data of a stage in the process. In the course of his paper, the author discusses the colouring of desert animals. He holds the view that the characteristic pale tones are the result of physical factors within the environment—the interaction of light and humidity being the most important. That an animal derives or does not derive a protective advantage from its desert colouration, has little influence upon the development of this particular character. As with all Ali's papers, his field notes on the various species observed by him, add to the merit and value of his work. The extensive ornithological surveys carried out by the Society have added considerably to the knowledge of the status and distribution of Indian birds, and have provided data for a more authoritative account of the avifauna of this country. But it will be many years before such a work can be undertaken by State agency. The knowledge acquired through these surveys is, however, already influencing publications on Indian avifauna.

In co-operation with the American Museum of Natural History, New York, we had planned a survey of the Sunderbans area, yet virgin territory to the ornithologist, but this project has now to wait better times, and survey work as a whole has been brought to an end by conditions imposed by the war.

Other bird papers and notes published during the year included Major J. K. Stanford's summary of the ornithological results of the Vernay-Cutting Expedition of 1938/39 to Northern Burma; a detailed report of which was published in another journal. We have once again to thank Mr. Lowther for his notes on Indian birds. Mr. Lowther's pictures and writings make a welcome and attractive feature of the *Journal*. Mention must also be made of Mr. Phillips' fine bird pictures, issued with his article on photographing in Ceylon's bird sanctuaries. Mr. Phillips has visited the many sanctuaries, now provided to give safe harbour to Ceylon's wild life. He writes of Giant's Tank, the largest of them, tucked away far from the beaten track. Its scenery and abundant bird life make it a paradise for the camera hunter.

REPTILES AND FISHES.

A new species of burrowing earth snake *Rhinophis dorsimaculatus* from Ceylon was described by Mr. P. E. P. Deraniyagala.

Dr. S. L. Hora and Mr. K. S. Misra, continued their serial on the game fishes of India. Parts XII, XIII and XIV were published during the year. In these papers, the authors study the 'mahseer' or large-scaled barbels of India. The identity of the 'Bokar' of the Assamese streams is traced to *Barbus* (L.) *hexagonolepis*, which occurs also in the rivers of Southern China, Siam, Burma and the Malay Peninsula, where it has been described under many different names. The identity of another Assamese 'mahseer,' known locally

as the '*Jungha*' is also investigated. As fresh specimens of this fish were not available, the conclusions reached are based on such material as was available in the Indian Museum. An appeal is made to anglers in Assam, to send Dr. Hora specimens of true '*Jungha*.' Other mahseer of Assam, which the authors would like to study, are those known locally as *Lohora*, *Burapetta* and *Bokar*. They may be cured in salt, if large, otherwise preserved in formalin or spirit. Assistance of this kind would help in fixing the exact status of these forms or species. The black mahseer is also discussed. The question was first raised in the *Journal* by Mr. R. E. Parsons who enquired whether the black mahseer of the Assam streams was a distinct species? The answer is that the black mahseer, photographed by Mr. Parsons, are indistinguishable from the common mahseer of Assam (*Barbus* [*Tor*] *putitora*). The black colouring is due to melanism, the counterpart of albinism. Both conditions may be seen in all forms of life, though of the two, albinism is more common. Such melanism has been observed in various species of mahseer found in the rivers of India and Burma; but its causes have yet to be investigated. Distinctions in colour, shape of body and thickness of lip have led people to distinguish various species of mahseer. But these distinctions are mainly individual in character and have no racial significance, and very little value in diagnosis. Dr. Hora also published a report on the fishes collected by the Vernay-Hopwood Upper Chindwin Expedition in 1935. An interesting account of the expedition and the area covered by it, was written by Capt. R. C. Morris and published in the *Journal* in 1936. Hora's report deals with the fishes collected in the Upper Chindwin drainage. Twenty-one species from this area are listed. Among them is a marine cat-fish whose capacity to ascend rivers so far above tidal influence is surprising. A new Burmese variety of fish, *Psilorhynchus homaloptera*, which was recently discovered in the Brahmaputra Drainage is described.

Mr. Prater's paper on the Whale-Shark, is an interesting study of the movements and wanderings of the greatest of existing fishes. The author adds a number of new records of the taking of this giant shark in the waters around India. The occurrence of whale-sharks mainly on the West Coast of India and Ceylon, between December and March, is due, it is shown, to the directional movements of surface current in the Bay of Bengal and the Arabian Sea. Coming in with the inflow of water from the Pacific, which sets in from the Straits of Sumatra on the establishment of the north-east monsoon, whale sharks following their drifting food, swim with the north-east monsoon drift, and are carried across the lower part of the Bay of Bengal to the south of Ceylon, from whence their journey northwards along the west coast of Ceylon and India is aided by the coastal current. The direction of the currents and the concordance of their movements with it, indicate that these sharks come to our shores from the East Indian Archipelago. The author provides evidence to show that the various archipelagoes in the Pacific and Atlantic Oceans, where whale-sharks are permanently resident, are centres from which numbers of these sharks, following

the drift of favourable currents migrate at appropriate seasons into areas where maximum plankton productivity provides them with an abundance of food. The archipelagoes, where alone the whale sharks are known to be permanently resident, are the breeding grounds to which they return after their wanderings in quest of food.

A paper of interest to those concerned with pisciculture in India, deals with the re-appearance of trout food in the waters of the Kulu Valley. The author, Mr. Hamid Khan, refers to the reduction in the available food supply of trout in the Kulu streams, caused by heavy monsoon floods during the months of July and August. Experiments undertaken by the writer show that the rich assemblages of insect larvae, which normally cover the stones of the stream beds, providing abundant food for trout, though dispersed by floods, reappear within the very brief period of four days. The food stoppage is of a temporary nature and the food resources of the Kulu streams are inexhaustible.

INVERTEBRATES.

Mr. D. G. Sevastopulo continues his notes on the early stages of Indian Lepidoptera. Parts VI, VII and VIII of his serial were published during the year. A second contribution by the same author deals with the food plants of the Indian *Agaristidae* and *Noctuidae*. It is a companion to his previous paper on the food-plants of the Indian Bombyces published in our Journal in 1940. Mr. E. P. Wiltshire describes 11 new species and sub-species of Lepidoptera from S. W. Iran. The author attributes the distinctiveness of the wood-land fauna of the Fars mountains to its isolation, by intervening desert tracts, and suggests that the forests of these mountains may have provided a refuge for the *relicts* of the woodland fauna which once inhabited the now denuded and barren mountains of the interior of Iran. Mr. Wiltshire's paper, is an abbreviated version of a proposed work intended to discuss the Saharan and other affinities of the Mesopotamian fauna; its completion has been prevented by the war. Under the term Mesopotamia, the author includes localities in Syria, Iraq and Iran, which are faunistically the same. His list is confined to desert species, that is species to which the desert is a means of distribution and a condition of existence.

In May 1879, Dr. Niceville caught a butterfly on a forest-clad road between Chamba and Kujiah, which Moore in his Lepidoptera Indica, described under the name *nicevillei*. This species was never recorded again until 1935, when Col. Bailey secured a number of these butterflies on the outskirts of the Nepal Valley, some 600 miles from where Niceville captured his single specimen. In all the intervening area, much of it well known to collectors, this species has never been seen. Niceville's specimen, now in the

Indian Museum, Calcutta, was described by Moore as a male, an opinion to which the authorities of the Indian Museum adhere, while experts at the British Museum consider it a female. Bailey concurring with the latter view, provides the first description of the male from the large numbers which he caught in Nepal. Whether the Nepal example represents a distinct race, cannot be decided till females are secured in Nepal or males in Chamba. The excellent plate published with the article, will help collectors to look for this rarity.

Caterpillars of the moth *Cirphis albistigma* are a serious pest of fodder grasses; a rich bed of grass might quickly be reduced to mere stumps by these voracious caterpillars. Methods for their control and an account of their life history was written by Messrs. M. C. Cherian and K. P. Anantanarayanan of the Agricultural Research Institute, Coimbatore. Mr. T. Venkatram of the Agriculture Research Institute described the life histories of 3 species of South Indian coccids, one of which is recorded for the first time from India.

We were able during the year to publish Part VIII of Martin Moseley's serial on Indian caddis flies. It contains descriptions of 3 new genera and 8 new species.

The introduction of insect pests from one country to another or their transport from one area to another by ship or rail has long been known, and with the advent of air-travel, facilities for such introduction have increased. Dr. P. Sen of the Bengal Public Health Department, shows how the range of *Anopheles sunndaicus*, a virulent carrier of malaria in the amphibious terrain of the Sundarbans, has been gradually extended to the confines of Calcutta, by transport in trains and country craft. Besides *A. sunndaicus*, various species of *Anopheles* are being transported to the city by these same means.

MOLLUSCS.

Collecting sea-shells, a hobby which Prince Albert made fashionable in the time of Queen Victoria, has lost its popularity in these less spacious days: but the interest is always there for those who would take pleasure in the infinite variety of shells found on our shores. Mr. D. Crichton, who has, written an account of the Madras shells, says that the total number of species known from this area, exceeds 700. He writes of the species which may be found on the shore, in the harbour, or by dredging. Numerous photos add to the usefulness of his paper.

BOTANY.

Three parts of the serial on beautiful Indian climbers and shrubs, by Dr. N. L. Bor and Mr. M. B. Raizada, were published during the year. This attractive serial when completed will be issued as

a companion volume to *Beautiful Indian Trees*, recently published by the Society.

Other papers published during the year included Professor d'Almeida's study of the biology and physiological anatomy of Indian marsh plants. Most of the species falling under this category are semi-aquatic, and the author's investigations were directed particularly to structural characters, induced by growth in water and air, and to the modifications brought about by periodic environmental changes, particularly profound in a country like India, with its sharply contrasted dry and wet seasons. Cherian Jacob describes a new species of *Coleus* under the specific name *vettiveroides*. Dr. Kundu describes two new *Nitellas*; one from Bengal and the other from the Murre Hills. Mr. McCann contributed a note on various aroids, supplementing hitherto incomplete descriptions and adding a species (*Synantherias sylvatica*) to the aroids known to occur in the Bombay Presidency. Mr. Sabnis completes his *Flora of the Punjab*: the two concluding parts of which were published during the year. Three parts of Mr. Sayeedud-Din's serial on common Indian herbs were published. Father Caius's contributions to the study of Indian medicinal and poisonous plants, covered the Labiates and the Dipterocarpaceae. A useful and timely contribution to the *Journal* was the paper by Col. Sir R. N. Chopra and others on the insecticidal and piscicidal plants of India. The need of cheap insecticides for the diverse needs of agriculture, destruction of household pests, and the preventing of vectors of malaria and similar insect-borne diseases is becoming increasingly imperative, and the supply has been considerably reduced by conditions imposed by the war. We are still dependent for most of our needs on imports from foreign countries. As the authors point out, India with its great variety of climate and edaphic conditions is particularly well suited for the cultivation of almost every plant. Its vegetation abounds in potential insecticides and insect repellents. The authors provide a list of those already in use, as well as those which have piscicidal properties. The distribution of such plants in India, their active principles and properties are also briefly mentioned. In addition a number of essential-oil-bearing plants which could be usefully investigated, are listed. The paper as such provides in compact form information which is useful to scientists, agriculturists and tradesmen interested in this essential and promising field.

GENERAL.

Col. R. W. Burton has once again contributed to the popular interest of the *Journal*, with his reminiscences of sport on the banks of the Narbada—happy scenes from happier days that seem to be lost for ever in the horror of our times. Our thanks are also due to all those who have contributed to the Miscellaneous Notes; always a most popular feature of the *Journal*.

PUBLICATIONS.

The *Book of Indian Birds* by Salim Ali, was published by the Society during the year. That it exactly provides the type of book that most people wanted, is seen in the wide and general demand for it. The thanks of the Society are due to the author.

NATURE CALENDAR.

The Nature Calendar produced by the Society was very popular. Our acknowledgments are due to Mr. E. H. N. Lowther, Major R. S. P. Bates, Mr. W. A. A. Phillips and others who very kindly gave their fine pictures for use with this Calendar.

REVENUE ACCOUNT.

Our total income for the year was Rs. 24,887-12-5 as compared with Rs. 29,340-10-6 during the previous year, showing a decrease of Rs. 4,452-14-1. The decline in revenue is serious and is a reflection of the critical times through which we are passing: the difficulties of maintaining contact with members have considerably increased, resulting in considerable outstandings due to the Society in subscriptions. An appeal is here made to all members to assist and stand by the Society during these times and help it to continue the work that it has done so well for over half a century.

MEMBERSHIP.

48 new members joined as against 44 in the previous year. 25 resigned in 1940 as against 24 in 1941. After deductions made owing to death or non-payment of subscription, the total membership including life members was 992, as compared with 996 in 1940.

ACKNOWLEDGMENT.

The Society has once more to express its indebtedness to Mr. W. S. Millard who has continued to attend to the Society's affairs in London. Insurance of the Society's stocks against war risks, and other matters required considerable correspondence and attention; all of which Mr. Millard gave freely, maintaining his long and cherished association with us.

We had to bid good-bye to Mr. H. M. McGusty, our popular Honorary Secretary, who has joined His Majesty's Forces. He carries with him the good wishes of the Society and its staff.

STAFF.

It is customary to close this report with the appreciation of the services of the staff; but few realise the amount of hard work and devoted service required of the Curator and his assistants, both Museum and clerical, to maintain and keep going the work of the Society in these difficult times.

J. F. CAIUS,
Hon. Secretary.

15th April 1942.

BOMBAY NATURAL HISTORY SOCIETY.

BALANCE SHEET AS AT 31st DECEMBER 1941.

[illegible]

Note.—A stock of 21,800 old Journals and the valuable research collection and Library of 2,600 volumes have not been taken into account on the Asset side of the Balance Sheet.

We have entered the above Balance Sheet from the Cash Book and from the information given to us and have verified the Investments.

We have prepared the above Balance Sheet from the Cash Book and from the information given to us, and have verified the investments.

In our opinion, such Balance Sheet represents a true and correct view of the state of the Society's affairs according to the best of our information and the explanations given to us.

BOMBAY, 16th March, 1942.

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Page 359—under Lakes, line 29 from top.

“ The correct weight of the fish caught by Major
Corbet is 50 lbs., not 60 as stated. ”

Page 658—under Misc. Note V, last but one line of the note—for

‘ Himalayas and Assam ’, etc., etc.

read

‘ Himalayas from Nepal, Assam ’ etc., etc

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Purple Wreath
PETREA VOLUBILIS Linn.
(half nat. size)

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SOME BEAUTIFUL INDIAN CLIMBERS AND SHRUBS.

BY

N. L. BOR, M.A., D.SC., F.L.S., I.F.S.,

Forest Botanist,

AND

M. B. RAIZADA, M.SC.,

Assistant Forest Botanist,

Forest Research Institute, Dehra Dun.

PART XII

(Continued from Vol. xliii, No. 2 (1942), p. 129).

(With 1 coloured and four black and white plates and 3 text-figures).

Verbenaceae.

This family takes its name from one of its genera, the well-known garden plant, *Verbena*. About 70 genera comprising some 800 species are included in the family, which is for the most part confined to the tropics and sub-tropics of south-east Asia and the Malayan archipelago. Few genera penetrate to the cooler regions of the earth and the *Verbenaceae* are poorly represented in Africa.

The family contains all types of plants from tiny herbs up to giant trees. The ultimate shoots are often quadrangular. The leaves are usually opposite, compound or simple, rarely whorled or alternate, exstipulate. The flowers are arranged in panicles or cymes. The calyx is inferior, bell-shaped, cylindrical or platter-like, 4-5- rarely 8-cleft, -lobed, or -toothed, occasionally entire. Corolla gamopetalous, cylindrical, expanded towards the top, straight or curved, 4-5-lobed, often 2-lipped; lobes imbricate. Stamens 4, rarely 2, inserted on the corolla; anthers 2-celled; cells often divergent, opening lengthwise. Ovary superior, seated on an obscure disk, 2-8-celled; often 4-celled; ovules solitary or paired, erect or rarely pendulous. Fruit a drupe or berry.

Many genera of this family, *Verbena*, *Clerodendron*, *Stachytarpheta*, *Congea*, *Petrea*, and *Holmskioldia* are favourite garden plants. *Duranta Plumieri* is grown everywhere as a hedge. The

best known species of the family, however, is *Tectona grandis*, the teak, whose timber is famous all over the world. Another tree is *Gmelina arborea*, which furnishes a timber of some value as a furniture wood.

Many species of *Verbenaceae* contain bitter and astringent principles and often, also, contain a volatile oil. A decoction of the root and leaves of *Verbena officinalis* is a powerful astringent and is applied to inflamed and bleeding piles. A decoction of the leaves of several species of *Lantana* are used as an expectorant. *Vitex agnus-castus*, a European species, produces berries which were supposed to be an aphrodisiac, these when roasted were supplied to the monasteries in mediaeval times under the delightful name of 'Monk's pepper'. *Vitex peduncularis* a tree common in Assam, contains a light yellow crystalline substance which is identical with vitexin, the active principle of *Saponaria officinalis* and *Vitex littoralis*. Dr. S. Krishna (Biochemist, Forest Research Institute) informs us that the mature leaves of *Vitex peduncularis* lose their vitexin. In Assam a decoction of the leaves is always used in cases of black-water fever and many cases are reported to have been cured by its use. Its reputation is so great that a large quantity of seed and even seedlings have been sent from Assam to other provinces.

The corolla of the species is usually tubular and is often brightly coloured and fragrant. Such an arrangement points to cross-pollination by insects or birds. In some species of *Clerodendron* the corolla tube is up to 6 in. long. In such cases the agents of cross-fertilisation are honey-birds and long-tongued *Lepidoptera*.

According to Koorders a species of *Clerodendron*, endemic in the Celebes, possesses a calyx which is always full of water, produced from numerous hydathodes seated upon the inner surface of the calyx (hydathodes are specialized epidermal cells which secrete water). The ostensible object of this production of water is to prevent robber insects from boring through the base of the corolla to the honey without cross-pollinating the flowers. This object is also achieved by certain species which develop extra floral nectaries on the calyx. The nectaries are occupied by ants which vigorously attack insects which attempt to get honey by illegitimate methods. Some *Clerodendrons* go so far as to allow ants to take up quarters in their stems in order to attain this object.

An interesting feature in certain genera is the colour-change which takes place as a flower matures. In one species of *Lantana* the change is from orange-yellow to dark crimson. This change has doubtless some connection between the ripening of the pollen and the receptivity of the stigma and may act as a guide to insects.

KEY TO THE GENERA.

- | | |
|--|----------------------------|
| Flowers in a narrow spike. | 1. <i>Stachytarpheta</i> . |
| Flowers panicled or cymose. | |
| Flowers clustered in a pink or mauve involucre ... | 2. <i>Congea</i> . |
| Flowers not clustered in an involucre. | |
| Calyx blue, lobed. | 3. <i>Petrea</i> . |
| Calyx green, white or red. | |
| Calyx red. | 4. <i>Holmskioldia</i> . |
| Calyx white or green. | 5. <i>Clerodendron</i> . |

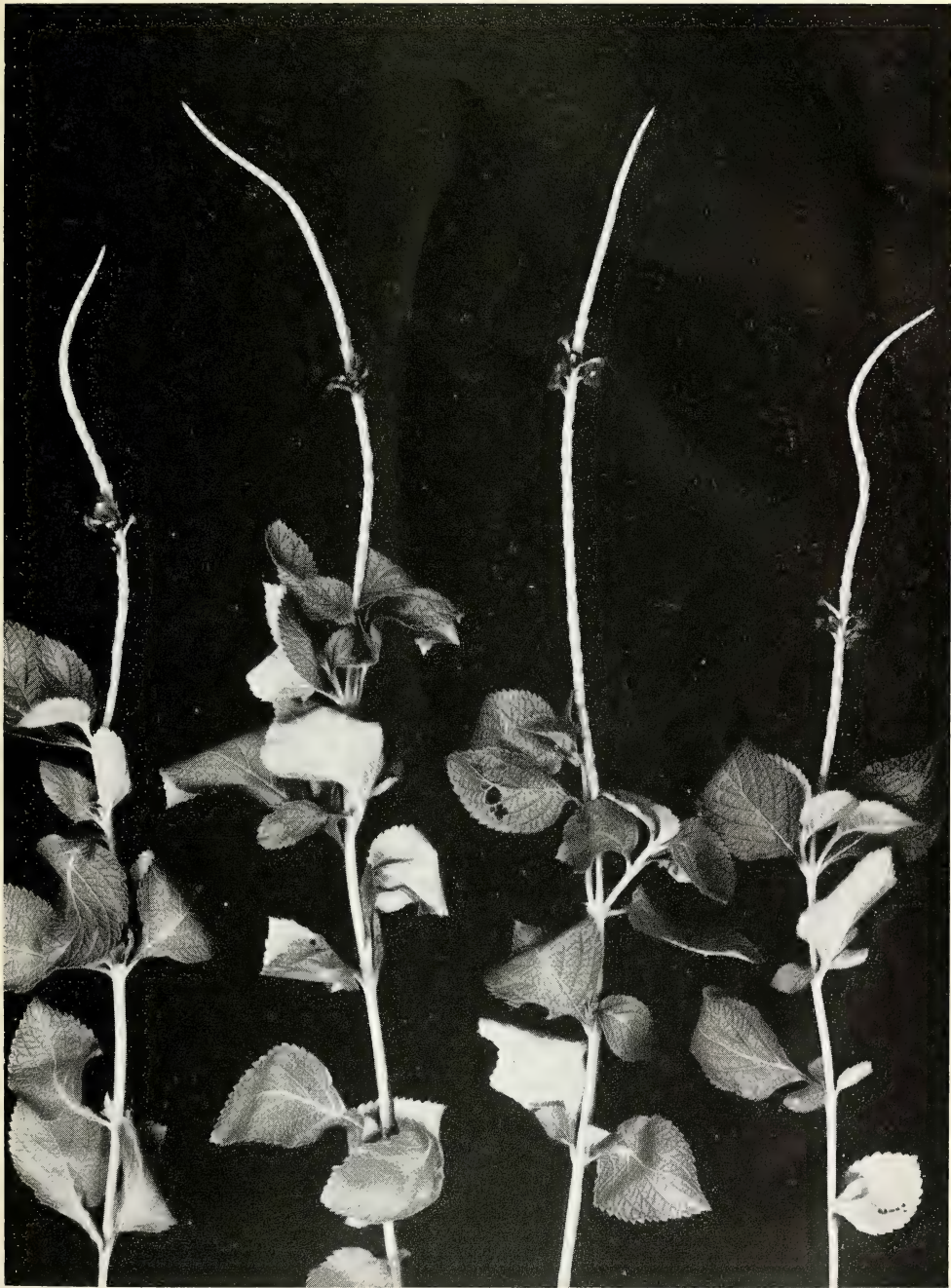


Photo by *Stachytarpheta mutabilis* Vahl. *M. N. Bakshi*
New Forest, Dehra Dun.



Photo by

Stachytarpheta mutabilis Vahl.

M. N. Bickhi

PART I.

1. *Stachytarpheta* Vahl.

(The generic name comes from two Greek words which mean 'spike' and 'thick' and together give a word-picture of the inflorescence).

Hairy or glabrous shrubs and herbs. Leaves opposite or alternate, toothed, exstipulate. Inflorescence a long terminal spike. Flowers solitary in the axils of bracts, sessile or half immersed in the rhachis; bracts lanceolate; bracteoles absent. Corolla-tube slender, cylindric; limb oblique with 5, equal or unequal, flat, spreading lobes. Perfect stamens 2 (the lower pair) included within the corolla-tube; staminodes 2, minute or absent; filaments short; anther cells vertical, divaricate. Ovary 2-celled; ovules solitary in each cell; style long filiform. Fruit enclosed in the calyx, linear-oblong, separating into 2, hard, 1-seeded bodies.

KEY TO THE SPECIES.

Corolla blue.	...	...	...	...	<i>S. indica.</i>
Corolla crimson or rose.	...	...	...	...	<i>S. mutabilis.</i>

***Stachytarpheta indica* Vahl. (*S. jamaicensis* (L.) Vahl.).**

Description.—A branchy annual herb, 1-3 ft. tall. Branches almost quadrangular, sparsely pubescent. Leaves opposite, petiolate, ovate or obovate, obtuse or acute at the tip, cuneate and long-decurrent at the base, dentate in the upper two-thirds, chartaceous or membranous in texture, glabrous on both surfaces or with a few hairs below, 1-4 in. long by 1-3 in. wide; petiole slender, winged, about .3 in. long.

Inflorescence of terminal curved, slender, long; spikes, 4-13 in. long; rhachis about .12 in. broad, excavated at the insertion of the flowers and the cavities covered by the bracts. Bracts lanceolate-acuminate, ciliate, scarious, .2-.4 in. long; bracteoles absent. Flowers sessile, blue, .6-.8 in. long. Calyx cylindrical, narrow, glabrous, membranous, 5-nerved, .25 in. long, split towards the rhachis, 4-5-toothed; glabrous, curved, hairy above and within. .3-.5 in. long, 5-lobed; lobes oblique spreading, rounded, about .4 in. long. Stamens 2, inserted



Fig. 1.—*Stachytarpheta indica* Vahl. $\times \frac{1}{2}$.

above the middle of the tube. Ovary glabrous. Fruit a pear-shaped long capsule, included in the calyx up to .2 in. long.

Flowers and Fruits.—Rainy season.

Distribution.—Native of tropical America, cultivated and naturalized in various parts of Asia and Africa.

Gardening.—A herb with deep blue flowers in long spikes. Propagated by seed.

Medicinal uses.—Said to be used in Malay as an abortifacient.

***Stachytarpheta mutabilis* Vahl.**

(*mutabilis* is a Latin word meaning changeable or variable, and refers to the colour of the flower which changes from crimson to rose).

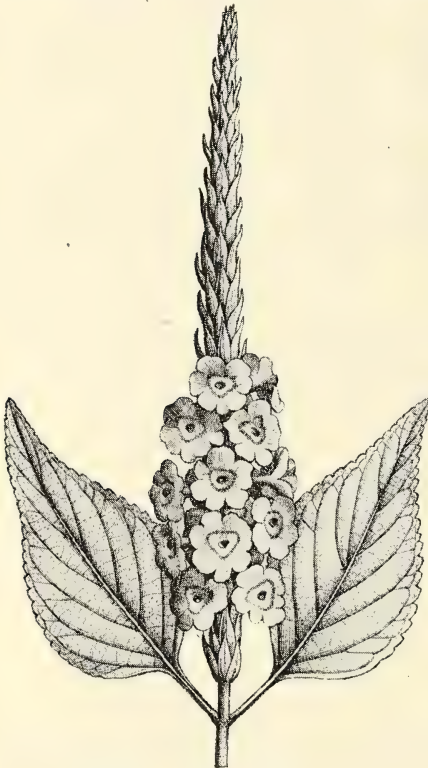


Fig. 2.—*Stachytarpheta mutabilis* Vahl. $\times \frac{1}{2}$

Description.—A herb, woody at the base, branches quadrangular; covered with a crisped pubescence. Leaves opposite or alternate, when opposite joined by a stipular line, petiolate, ovate, ovate-oblong or elliptic, acute or acuminate at the tip, cuneate and long decurrent at the base, serrate-dentate on the margins, rather rough on the upper surface, softly pubescent or scabrid on the lower surface; petiole up to .5 in. long, slender, grooved above, pubescent. Inflorescence a stout terminal spike up to 1 ft. long. Rhachis terete, pubescent, excavated at the insertions of the sessile flowers; excavations covered by the oblong, acuminate-awned bracts, bracts .3 in. long without the awn, pubescent, bracteoles absent. Calyx narrow-tubular, 4-ribbed, 4-toothed, .3-.5 in. long; teeth short, acute. Corolla tube cylindrical, curved, .4-.5 in. long; limbs 5-lobed; lobes orbicular, irregular in size, .2-.4 in. wide. Flowers crimson fading to rose. Stamens 2, included in the corolla tube. Ovary glabrous; style long slender; stigma capitate, exserted.

Flowers and Fruits.—Rainy season.

Distribution.—Native of tropical America, now cultivated in the plains throughout the country.

Gardening.—A shrub 3-5 ft. high with 4-angled, tomentose-villous branches. The flowers are scarlet fading to rose and are

borne in long spikes. To keep it in good shape it is advisable to trim it after the rainy season. Easily propagated by seed.

Medicinal uses.—The leaves are powdered and mixed with lime and applied to wounds and sores. It is also said to be used as an abortifacient.

2. *Congea* Roxb.

Climbing shrubs with opposite leaves. Inflorescence of small, involucrel cymes arranged in terminal panicles. Involucre 3-phyllous, spreading, supporting a sessile 6-9-flowered cyme. Calyx tubular, widened at the mouth, 5-cleft, persistent. Corolla 2-lipped, the tube as long as the calyx; limb very unequal, the upper lip elongate, erect and 2-cleft, the lower spreading and shortly 2-lobed. Stamens 4, didynamous, inserted in the throat and long exserted; filaments filiform; anthers dorsifixed, 2-celled. Ovary 2-celled; ovules 2 in each cell, pendulous; style capillary with a 2-cleft stigma. Fruit a coriaceous capsule, indehiscent, 1-seeded by abortion.

Congea tomentosa Roxb.

(*tomentosa* is derived from the Latin word *tomentum*, the stuffing of a pillow and is usually used to describe a shaggy pubescence).

Description.—A large deciduous scandant shrub. Branches and young parts covered with a soft or rough, short, shaggy pubescence. Leaves opposite, exstipulate, ovate to ovate-oblong in shape, petiolate, 4-5 in. long, 2-4 in. wide, obtuse or rounded at the base, acute or acuminate, entire; petiole about .2-.3 in. long, pubescent; upper surface very rough to the touch; under surface softly hairy to almost hirsute on the mid-rib; nerves prominent below.

Inflorescence simulating a large compound terminal panicle; main branches pubescent, opposite. On the branches are opposite, pedunculate cymes of flowers. Peduncles supported at the base by a velvety bract, .25 in. long. Peduncle up to 1 in. long, hairy. At the top of the peduncle is an involucre of 3 bracteoles connate at the base, forming a very small cup; bracteoles elliptic-obtuse, oblanceolate, obovate in shape,



Fig. 3.—*Congea tomentosa* Roxb. $\times \frac{1}{2}$.

velvety-tomentose on the inner surface, tomentose and veined outside, pale purple, pink or whitish in colour, up to 1 in. long. Flowers in cymes sessile in the involucre. Calyx gamosepalous, covered with dense hairs. .25-3 in. long, 5-lobed; lobes acute. Corolla gamopetalous, as long as the calyx tube, tubular, constricted above the ovary, 2-lipped, glabrous, whitish. Stamens 4, didynamous; filaments as long as the corolla. Ovary glabrous; style filiform. Fruit an indehiscent capsule.

Flowers.—December-March.

Distribution.—Native of Manipur, Chittagong, Burma and Siam. Frequently cultivated in gardens in India.

Gardening.—A strong deciduous climber allied to *Petrea volubilis*, and conspicuous for the persistent pinkish-mauve bracts which cover this vine during spring and remain on the plant for a long time. It is usually propagated by seed as cuttings take root with difficulty. The plant commonly cultivated in gardens is var. *azurea* Wall.

3. *Petrea* (Petraea) Houst. ex Linn.

(This genus was named in honour of Lord Petre (1713-1743) Thordon, Essex, who in his short life had managed to put together the finest collection of exotic plants then existing in Europe).

Shrubs, trees, or woody vines. Leaves opposite or whorled, deciduous, exstipulate, rough. Inflorescence an axillary or terminal, many-flowered raceme. Calyx inferior, gamosepalous; tube campanulate, usually ribbed, 5-lobed, lobes longer than the tube, coloured. The rim of the calyx often bears a 5-lobed, calicinal crest. Corolla gamopetalous, inferior, darker blue or purple than the calyx or white, slightly irregular, 5-lobed; lobes collected into 2 lips; one of 2, the other of 3 lobes. Stamens 4, didynamous, included in the corolla tube and inserted on it close together near the middle, filaments short and slender, anthers oblong. Ovary subglobose, 2-celled; ovules 1 in each cell. Fruit a drupe enclosed by the mature calyx.

Petrea volubilis Linn.

PURPLE WREATH.

(*volubilis* means twining in Latin and refers to the habit of the plant).

Description.—A woody vine or undershrub with greyish bark on the old wood. Branches and branchlets slender, prominently lenticellate, shortly hairy. Leaves opposite, exstipulate, petiolate, firmly membranous, rather dull-green above, brighter green beneath, very rough to the touch, 2-8 in. long by 1-4 in. wide, acute or shortly acuminate at the apex, cuneate at the base; petiole up to .5 in. long, densely or sparsely pubescent.

Inflorescence a drooping, many-flowered raceme, solitary in the axils, up to 12 in. long; rhachis puberulent. Individual flowers pedicellate; pedicels .3 in. long, obscurely hairy. Calyx gamosepalous; tube cylindric, about .12 in. long, not ribbed, densely pubescent outside, 5-lobed; lobes membranous, oblong, .75 in. long



Photo by

M. N. Bakshi

Purple Wreath.
Petrea volubilis, Linn.
New Forest, Dehra Dun.



Photo by

Purple Wreath.
Petrea volubilis, Linn.
New Forest, Dehra Dun.

M. N. Bakshi

by .25 in. wide, lilac or blueish in colour, rounded at the apex; calicinal crest composed of five membranous, triangular-ovate lobes. Corolla hypocrateriform, .3 in. long deep blue or purple, with an infundibuliform tube, lower three quarters glabrous, upper quarter densely pubescent, 5-lobed; lobes broadly elliptic. Inner surface of the corolla-tube puberulent, densely pilose at the base of the stamens. Stamens 4, didynamous, inserted on the tube; filaments filiform, glabrous; anthers oblong; staminode obsolete. Ovary oblong-obovoid, glabrous, seated on a conspicuous disk; style filiform; stigma obliquely capitate. Fruiting calyx up to .17 in. long, densely pubescent.

Flowers.—March-April. Sometimes with a second flush in October. It does not fruit in this country.

Distribution.—Native of tropical America. Now commonly cultivated throughout the tropics.

Gardening.—The 'Purple wreath' is one of the most distinct and beautiful of cultivated climbers. It bears long spikes of cloudy-blue star-like flowers which are extremely effective when massed. It can be used not only as a climber but can be trained as a standard. The flowers begin to open at the base of the spike-like raceme and the showy 5-pointed star is the calyx, whose sepals are coloured like petals. The calyx spreads open while the corolla is still like a bud in the middle and remains long after the corolla has fallen, so that the vine, at first glance, appears to bear two kinds of flowers. Propagated by layers and gooties or from suckers which it frequently sends up.

THE LARGER DEER OF BRITISH INDIA.

BY

R. I. POCK, F.R.S.

(Zoological Department of the British Museum, Natural History).

(With 8 text-figures).

The exceptionally interesting species of Deer (*Cervidae*) inhabiting British India are so well known to sportsmen and naturalists and, for the most part, so easily distinguished by their antlers and other external features that, recently at all events, no special attention has been paid to the detailed structure of their skulls. In a series of papers dealing with them, which it is my intention to publish, an attempt has been made to remedy this defect and establish the resemblances and differences between the skulls of the various species.

Of the species contained in this first instalment, two, namely the Kashmir *Barasingh* or Hangul and the Shou, are known to occur within the precincts of British India; but the precise habitat of the third, Wallich's Deer, is not yet ascertained, although the species has been frequently quoted by writers on the Big Game of the country, has been exported from N. India, and is admittedly closely allied to the first two. To these has been added Przewalski's Deer, an inhabitant of Tibet. The pretexts for its inclusion here are the record of the importation of a head and antlers to Darjiling, the realisation of the possibility of the recurrence of that event, and the difficulty a sportsman or museum curator might have in identifying such a trophy.

The facts recorded in this paper are mainly based on specimens preserved in the British Museum. It is only necessary to add at present that the four species above referred to are distinguished from the rest of the British Indian Deer by the short and short-haired tail, the conspicuous pale area on the rump, the comparative narrowness of the rhinarium below the nostrils in front and by the antlers. These obvious external characters have been known for a long time, for the most part.

Cervus wallichii, G. Cuvier.

(Wallich's Deer).

Cervus wallichii G. Cuvier, Oss. Fossiles, 1812 (according to Pousargues Mem. Soc. Zool. Fr. 11, p. 195, 1898); id. Oss. Foss. ed. 3, 4, p. 504, 1825; id., op. cit., ed. 4, 6, p. 88, 1835; F. Cuvier and Geoff. St. Hilaire, Hist. Nat. Mamm., 4, No. 356, 1823. The description and figure published in these works have been cited by many subsequent authors, including Pocock, Proc. Zool. Soc., 1912, pp. 559-565 (photograph) and Lydekker Cat. Ung. Brit. Mus., 4, pp. 141-142, 1915.

Harana wallichii, Hodgson, Ann. Mag. Nat. Hist., 1, p. 154, 1838.

Pseudocervus wallichii, Hodgson, Journ. As. Soc., 10, pt. 2, p. 914, 1841.

Locality of the type¹ and distribution not ascertained.

A comparatively large stag, standing about 51 in., close on 13 hands, at the withers and characterised by the great size of the white rump-patch, which is very wide above the tail and reaches the summit of the croup; its median length above the tail a little surpassing twice the length of that organ. In the size of this area the species differs from all the known forms of *Cervus*, except the Wapiti, but the area differs from that of the Wapiti in being clean white instead of buffy and in being narrower below on the back of the thighs on a level with the apex of the tail, that organ being also clean white and quite short. The general colour (in March) is decidedly pale, being a tolerably uniform yellowish or sandy-brown all over, except on the forehead which is browner, the cheeks and backs of the ears which are greyer and the muzzle and chin which are pale fawn. The individual hairs show no dark and lighter speckling.

This description is abridged from the account I published in 1912 of an adult stag presented to the late King by the Maharajah of Nepal and exhibited in the Zoological Gardens, London. It was stated by Col. Manners Smith (*The Field*, July 31, 1909, p. 239) to have been captured as a fawn in the upper reaches of the Sanpo Valley, close to Lake Mansarowar. So far as I am aware this specimen and the two exhibited in the Barrackpore Menagerie are the only representatives of *C. wallichii* that have ever been described and figured.

The specimen in the Zoological Gardens lived several years after my account of it was published. A peculiarity of its moult was the shedding of the old dead hair before the new coat appeared, leaving the dark skin naked²—no doubt an individual peculiarity—; but there was no noticeable seasonal change in tint; and three years before it reached England, while still in captivity in Nepal, Col. Manners Smith described its colour as 'very light'. These facts suggest that *wallichii* is throughout the year paler in tint than the Shou and the Hangul or Kashmir Stag. The colour of the original specimen is doubtful since it was described from a coloured sketch and was said to be dark grey-brown or yellowish grey-brown. It is not clear how it could be both; but yellowish grey brown suggests a pale hue agreeing tolerably closely with that of the example I described.

The antlers of the type were quite small and apparently degenerate with old age, the brow and bez tines being short and the trez absent.

¹ Cuvier's description was taken from a figure sent to him by Duvaucel of one of a pair, according to Blyth, exhibited in the menagerie at Barrackpore and alleged to have come from Maktinath, north of Dwalagiri in Nepal. Although Hodgson gave two generic names to this stag, he never saw it and knew it only from Cuvier's figure.

² Year after year at this period well meaning but misguided correspondents used to write to me denouncing the conduct of the Society for exhibiting such a disgracefully mangy animal!

The left antler of the example in the Zoological Gardens, which was shed on the voyage to England when the stag was about 5 years old, was normal but small and indistinguishable from the antlers of some Shou and of the Kashmir Barasingh, as shown by the photograph in my paper (p. 563). The same applies to a second pair shed in 1913 and preserved in the British Museum (no. 15.5.11.1). These antlers are only about 40 ins. long, their small size, as in the case of the other pair referred to, being no doubt due to deficiency of diet in captivity.

The skull is unknown. Probably it will prove to be like that of the Shou (*C. affinis*).

I have provisionally regarded Wallich's Stag as specifically distinct from the Shou because so far as I am aware there is not any evidence that the two intergrade in the size of the rump patch.

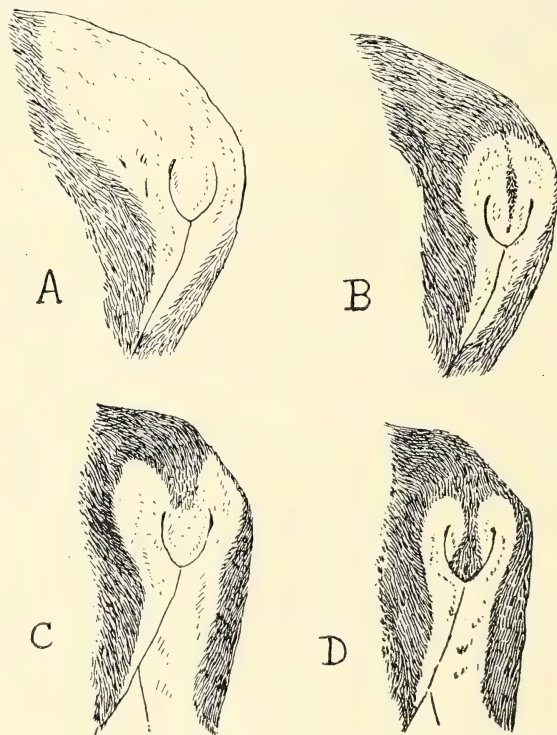


Fig. 1.—A, rump of Wallich's Deer (*Cervus wallichii*) copied from *Proc. Zool. Soc.*, 1912, p. 561, Fig. 67; B, the same of the Shou (*Cervus affinis*) drawn from Col. Rennick's specimen from the Chumbi Valley; C, the same of the Hangul (*Cervus hanglu*) copied from *Proc. Zool. Soc.*, 1912, p. 566, Fig. 70; D, the same of another Hangul drawn from Major Powell Cotton's specimen from the Sutlej Valley.

***Cervus affinis*, Hodgson.**

(The Shou).

Cervus affinis, Hodgson, Journ. As. Soc. Beng., 10, pt. 2, p. 721, pl., 1841; id. op. cit. 19, p. 466, 1850; id. op. cit., 20, p. 388,

pl. 7, 1851; and of many subsequent writers including Pocock, Proc. Zool. Soc., 1912, p. 567, Lydekker, Cat. Ung. Brit. Mus., 4, p. 142, 1915, (cited as subspecies of *wallichii*); and Burrard, Big Game Hunting in the Himalayas and Tibet, p. 220, 1925 (cited as *wallichii*).

Cervus tibetanus, Hodgson, Journ. As. Soc. Beng. 19, p. 466 1850.

Cervus nariyanus, Hodgson, 20, p. 392, pl., 1851.

Locality of the type unknown; originally stated by Hodgson to be the Sāl forests in the Morung or eastern Tarai of Nepal; but subsequently in 1850 he withdrew this statement, declaring that the species is not found there and that the trophy must have been imported.

Distribution (according to Burrard):—the Chumbi Valley, which is a basin of the Ammu River, a tributary of the Raidak, also in Bhutan in the Valley of the Raidak which flows through that country.

Resembling *C. wallichii* in size but distinguished from the two described examples of the latter by its much smaller white rump-patch which, above the root of the tail, is considerably narrower and shorter, extending at most about half way between the root of that organ and the summit of the croup. Moreover, it is always marked by a more or less pronounced darkish median line which is strongest on the upper half of the tail and may extend to the pigmented hairs on the upper half of the croup. The general colour too is also apparently considerably darker, at all events at certain seasons of the year, the pelage is distinctly speckled and the belly is more sharply contrasted by its blackish hue with the pale flanks.

This stag was described from a skull with antlers. Ten years later from 'abundant supplies' sent to him, he alleged, from Dingcham, N. of Sikkim, Hodgson described the colour of the winter coat (February) as 'earthy brown, more or less lutescent, the head and neck being concolorous with the back,' but the flanks were conspicuously paler than the back and sharply contrasted with the black belly; the limbs were paler than the back but darker than the flanks and earthy brown in front and externally; the caudal disc was 'remarkably small' but sharply contrasted and marked with a 'dark mesial line.' Presumably this description of the size of the caudal disc as remarkably small meant in comparison with that of *C. wallichii*, as figured and described by the two Cuviers and Geoffrey St. Hilaire.

Three flat skins in the British Museum, one presented by Hodgson, labelled 'N. India' and two presented by Blanford and labelled 'Sikkim (Mandelli)' show that the dividing line of the small rump-patch is variable in distinctness, in one case being only just traceable, and that the patch itself may be set off marginally by unspeckled hairs, darker than those of the rest of the rump; the general colour is dirty brown or greyish brown, darker than that of the example of *C. wallichii* exhibited in the London Zoological Gardens.

These remarks are an epitome of my description of *C. affinis* published in 1912. Since then the Museum has received a specimen,

mounted in the gallery, from the Chumbi Valley which was presented by Col. Rennick. Some particulars about this may be interesting. The length of the head and body over the curves is 87 inches, the tail is about $3\frac{1}{2}$ inches and the standing height at the withers 52 inches, exactly 13 hands and almost the same as in the example of *C. wallichii* I described. The coat is rough here and there, suggesting that the moult had started, but it is thick and about 52 mm. long on the body and about 70 on the neck; the general colour is pale, grey with a slightly brownish tinge, closely recalling the tint of the example of *C. wallichii* and most emphatically not 'earthy brown' as described by Hodgson; the flanks are a little lighter than the back but the belly is much darker and the crown, muzzle and legs are browner than the body; the rump-patch extends about one-third of the way between the root of the tail and the summit of the croup, slightly more than the length of the tail and its median dark line is faint in front, stronger below and on the upper half of the tail; the gland on the hind leg is $6\frac{1}{2}$ inches below the hock and 10 inches above the false hoof of the same side.

Antlers. Most of the recent descriptions of the antlers of the Shou are wrong. They are taken from a skull in the British Museum belonging to Hume's collection (Mandelli coll. no. 12.10.31.4). A front view photograph of this skull and antlers is given in Rowland Ward's *Records* and several of Lydekker's works. These antlers have been regarded as typical of the species (*C. affinis*). They are, on the contrary, quite abnormal, their essential peculiarity consisting in the abrupt, nearly rectangular bend of the beam just above the trez tine when viewed from the front. Not one of many other pairs I have seen shows such a bend from that aspect, although from the side a similar bend is sometimes exhibited. They have also been described as bending 'suddenly forwards at the trez tine, so that the upper half overhangs the face.' This alleged feature has also been regarded as characteristic of the species. It does not exist. When the skull is resting on a flat surface, with the cranio-facial axis horizontal, the beam of the antler from the side shows a slight forward trend below the trez tine; but from that tine to the tip it is as nearly as possible vertical, without a trace of forward bend, the terminal tines being above the occiput. The upper half of the antler can only be made to overhang the face by steeply tipping the skull so that the muzzle is much lower than the occiput. It can similarly be made to overhang the position of the withers by tipping the skull sufficiently the other way. But these statements are true of many species of *Cervidae*. In no skull of the Shou that I have seen does the upper half of the antler overhang the face when the cranial axis is horizontal.

As stated above, the antlers of the skull in the Hume collection, above discussed, are unique in the abrupt angulation of the beam above the trez tine from the anterior aspect. In some other antlers the axis of the beam above the trez tine is, from this point of view, evenly curved up to the terminal tines. This is the case in a pair (Hume and Mandelli, no. 91.8.7.6); in the mounted specimen from Chumbi (Col. Rennick); in Hodgson's types of *affinis* (no. 45.1.8.94) and of *tibetanus* (no. 57.12.14.3) and, judging from the figure, in his type of *nariyanus*. In others there is a slight, very obtuse

angulation at the *trez* tine. This is shown in pairs received from Blanford (no. number); from Hume and Mandelli (no. 91.8.7.7),

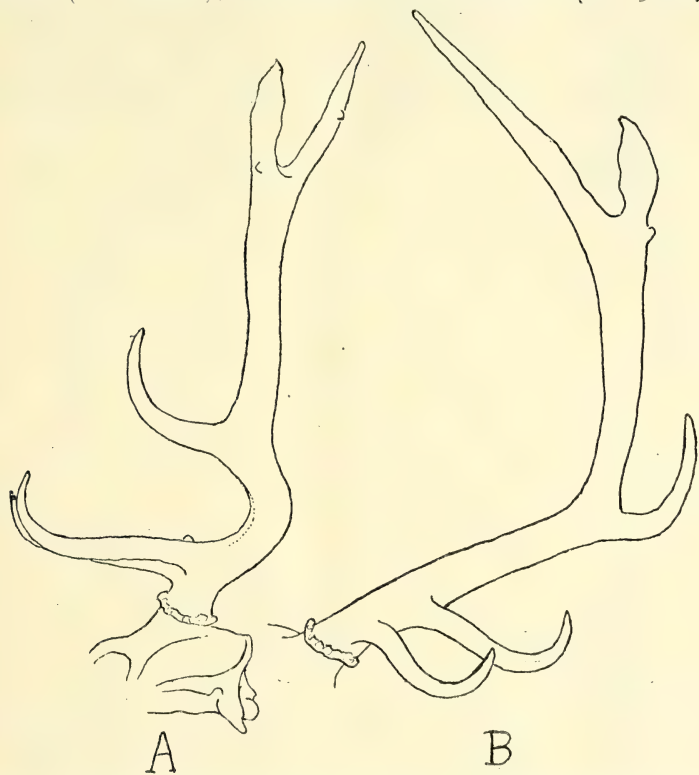


Fig. 2.—A, side view of left antler of Hume's and Mandelli's historic skull of the Shou, the beam below the *trez* tine and the inner terminal tine greatly foreshortened. This antler has often been described as bending suddenly forwards at the *trez* tine so that the upper part overhangs the face!; B, front view of the same antler showing the abnormal; not characteristic angulation at the level of the *trez* tine from this aspect.

from Hodgson (no. 57.12.14.2) and others. In one pair only (Ind. Mus. no. 79.11.21.47) does the beam from the front aspect show a somewhat abrupt angulation at the *trez* tine so that the inner terminal tines are comparatively close together at their points; but the bend is not so abrupt as in Hume's first described skull (no. 12.19.31.4) and occurs higher up the beam, the *trez* tine rising closer to the terminal fork than to the *bez* tine, although the *bez* tine itself rises considerably above the brow tine, not close to it as in the Hume skull.

From the lateral aspect differences in the curvature of the antlers may be strongly marked. In Hodgson's type, as shown in his figure, the beam makes an abrupt nearly rectangular bend below the *trez* tine and above the bend runs upwards with a slight backward trend. In his figure of the entire animal sent to him by Dr. Campbell, the beam presents a similar bend, but in this case it is apparently at about the level of the *trez* tine or beyond it.

In Hume's historic skull (no. 12.10.31.4) and in his other one (no. 91.8.7.6) the antlers are as strongly and similarly angulated. No two of these antlers are precisely alike, but it is needless to describe the differences, the only feature of interest being the absence of the trez tine in the left antler of Hume's second specimen. In most of the other skulls, referred to above, the beam in side view

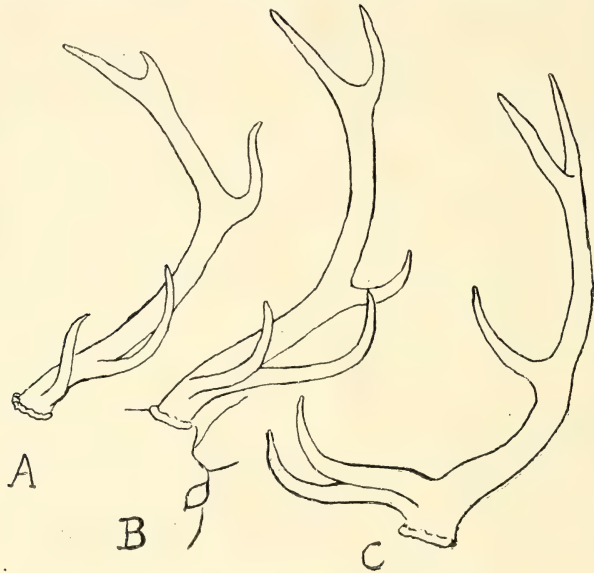


Fig. 3.—A, front view of the left antler of Shou (Indian Museum) showing the abnormal, abrupt inward bending of the beam at the highest trez tine; B, front view of the left antler of the Shou from the Chumbi Valley; C, side view of the same antler the curvature of the antler is much more normal for the species than the antler depicted in fig. 2.

shows a nearly even curvature, with at most, a slight deviation at the trez tine. From these facts it is clear that the statement that the antlers of *C. affinis* are characterised by an abrupt angulation of the beam is only true of some skulls.

There are still one or two points to notice. Reference was made above to the absence of the trez tine in the left antler of Hume's skull (no. 91.8.7.6). In the type of *nariyanus*, as figured by Hodgson, there is only a single tine midway between the brow tine and the terminal fork; and the same is the case in the right antler of Blanford's head (no number). It is not possible to determine whether this tine represents the bez tine or the trez tine. But Blanford's skull is old, the crowns of the incisiform teeth being worn almost to the root. Hence there seems to me to be no doubt that the abnormality of the right antler is due to age-decadence.

Finally it may be added that the variation in the antlers in the Shou is greater than in any species of deer I can at present recall, much greater than in the Hangul from whose antlers those of the Shou are sometimes hardly distinguishable.

Of seven adult skulls in the British Museum not one has a trustworthy locality, nearly all being labelled 'N. of Bhutan.' The

longest, marked 'Sikkim' (without further history), has a total length of 465 mm. (about $18 \frac{3}{5}$ inches) and a condylobasal length of 441 mm. (about $17 \frac{3}{5}$ inches); the shortest, Hodgson's type, (no. 45.1.8.49) has a total length of 433 mm. (about $17 \frac{1}{4}$ inches), but the occipital condyles are missing. The total length of the rest is between 440 and 450 mm. Only one of these is complete with its condyles (Ind. Mus. no. 79.11.21.42). This has a total length of 444 mm. (about $17 \frac{4}{5}$ inches) and a condylobasal length of 427 mm. (about 17 inches). Since the seven skulls have an average total length of 449 mm., the average condylobasal length may be put at about 430 mm.¹

Some individual variations of the skulls in other particulars are shown in the table of measurements. The nasals differ considerably in shape in individual skulls. In the type they are very nearly three times as long as wide at their widest point between the facial vacuities and they penetrate deeply between the frontal processes forming an acute angle, the apex of which surpasses by some 20 mm. the posterior ends of the vacuities. But in

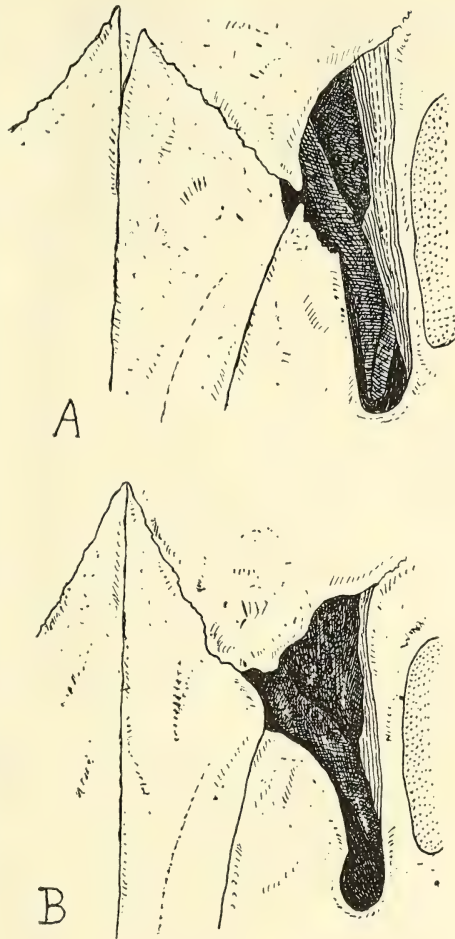


Fig. 4.—A, upper part of left nasal bone, with the vacuity and inner half of the gland pit (dotted) of one of Hodgson's skulls of a Shou, showing the nearly complete separation of the vacuity from the nasal bone; B, the same of the type of *Cervus affinis*, showing more normal extent of contact between the nasal bone and the vacuity in this species.

¹ Some years after Ward photographed Hume's historic skull (no. 12.10.31.4); it fell from the wall where it was suspended and the entire facial portion was smashed. I am unable therefore to give its measurements. But there is nothing exceptional in its orbital and postorbital widths. It must be explained that measuring most of the skulls of this species and of the next and drawing parts of them have been difficult owing to their being mounted on wooden blocks and placed high up on the walls or on the tops of exhibition cases in the Museum gallery. The recorded dimensions may, therefore, be a few mm. out either way. But such errors as there may be are of no great moment considering the size of the skulls.

the skull presented by Blanford the width is a good deal less than twice and a half times the length and they penetrate less deeply between the frontals, the tips being nearly rectangular and about on a level with the posterior ends of the vacuities. At the anterior end they may end in two processes, but the outer process may alone persist. The extent to which they surpass in front the anterior edge of the nasal branch of the premaxillae varies considerably; and their width at that point in Blanford's skull is less than half their greatest width, whereas in two of Hume's and Mandelli's skulls it is considerably over, the nasals in the first skull being exceptionally broad behind and narrow in front, the converse being the case in the latter two.

The most interesting point connected with the nasals of this species is the general shortness of their free edge where they abut against the vacuity, this feature being mainly due to the backward extension of the maxillae between the nasals and the vacuity. The length of the free edge may vary on the two sides. In Blanford's skull, for instance, it is 17 mm. on the left side, 12 on the right, the first figure being quite exceptionally large. In other skulls the free edge varies from 14 mm. in the longest skull, 11 mm. in the type to 8 and 5 in the rest. In one of Hodgson's skulls (no. 57.12.14.2) the main space of the vacuity is almost cut off from the nasal on the left side by a forwards projecting process from the maxillae which are only 1 mm. apart at their tips. In no other species of Oriental Deer are the nasals so nearly cut off from the vacuities. Owing to the backward encroachment of the maxilla between the nasals and the vacuities, the anterior portion of the latter in front of the free edge of the nasals is longer, sometimes considerably longer than the posterior portion behind it.

The gland-pit is smallish, its length being less than the vertical diameter of the orbit (inside measurement).

I am indebted to Col. F. M. Bailey for the following note on the distribution of the Shou, based on his own experience:—"Shous used to be fairly common on the ridge east of the Chumbi Valley between that valley and Bhutan. East of this there used to be some in Bhutan. They lived I think in Bhutan but came over the ridge into the Chumbi Valley in the summer and autumn. About November and December the Chumbi Valley people cut fuel for their winter supply. Deep snow does not usually come till later. This disturbs the forest and drives the deer back into Bhutan. In the summer of 1921 I saw two hinds and a young one above Lingmotang in the Chumbi Valley. There must have been very few left and I believe all were exterminated a few years ago, as I am told there are none in this part of Bhutan now. I saw a few in the district of Tsari. Here the Shou will be more or less artificially preserved for a long time I hope, as the place is very holy and no life may be taken there."

***Cervus hanglu*, Wagner.**

(The Hangul, Hanglur or Kashmir Barasingh).

Cervus hanglu, Wagner, Schreber's Säug. Suppl. 4, p. 352 (foot-note) 1844; Pocock, Proc. Zool. Soc. 1912, p. 566.

Cervus cashmerensis, Gray, List. Ost. Brit. Mus. p. 65, 1847, altered on p. 147 to *C. casperianus* (*nomina nuda*).

Cervus casperianus, Gray, Cat. Mamm: Brit. Mus. pt. 3, Ung. pl. 27, fig. 3 and pl. 28, fig. 1 (skull) 1852.

Cervus cashmeriensis, Adams 1858; *cashmeecrianus*, Falconer 1868, *cashmirianus*, Fitzinger, 1874, *cashmiriensis*, Lydekker, 1915, *Kashmiriensis*, Burrard 1925. (Of these variants of the same name, the second and third have been most frequently adopted. Lydekker rejected *hanglu* because he didn't like it and used *cashmirianus* till 1914 but substituted *cashmiriensis* in 1915.

Locality of the types of *hanglu*, *casperianus* and *cashmeriensis*: Kashmir.

Distribution:—In winter most of the nullahs from west of the Wular Lake to Kistwar and as far east as the borders of Chamba State; in summer at higher altitudes in the more lonely forest farther West (Arbuthnot in Burrard's book 1925).

Distinguished from the Shou by its smaller size, greater contrast in colour between the muzzle and the rest of the face owing to the whiteness of the chin and upper lip and the pale hue of the side of the muzzle up to and behind the nostrils; there is also more white round the eye, and on the throat and belly; there is no record of a greyish phase in the pelage which is darkish brown above, rather paler on the flanks, with a pale speckle in the contour hairs, as in the Shou, and the legs are darker than the flanks; the pale area on the rump is about as extensive as in the Shou except that above the root of the tail it is divided in the middle line by a much broader brown band continuous with the colour of the upper part of the croup and sometimes continued all down the middle of the tail to its tip.

This diagnosis is abridged from my description published in 1912, when I resuscitated Wagner's name *hanglu* for the species. In that paper were given the main characters of *C. wallichii*, *C. affinis* and *C. hanglu* and it was claimed that *affinis* is in some respects intermediate between the other two, having the size and coloration of the face of *wallichii*, but much more closely resembling *hanglu* in the small size of the pale rump-patch.

Recent comparison between the skulls of *affinis* and *hanglu* has shown that those of the latter are about two inches shorter and further differ, as explained in some detail below, in the longer free edge of the nasals where they abut against the facial vacuity. There is no constant difference between the antlers of the two; but those of the *hanglu* never, so far as the heads I have seen are concerned, show from the front view the abrupt angular bend described in two specimens of *affinis* and, on the available evidence, those of the *hanglu* are more liable to develop at least one accessory tine at the tip, which may arise either from the outer or inner of the two normal terminal tines.

Only one skin of *hanglu* is at present available for examination. This is a mounted adult stag from the Sind Valley and received from Major Powell Cotton. It bears out the description given above; but a few notes on it may be of interest by way of comparison with the mounted specimen of *affinis* from the Chumbi Valley, described above, and the mounted specimen of Przewalski's

Tibetan Deer, the type of *thoroldi*, described below, both of which stand alongside it in the exhibition case.

The length of the head and body over the curves is 79 inches and the height at the withers $47\frac{1}{2}$ inches, both dimensions being noticeably less than in the Shou. The coat is about 50 mm. long on the body but on the nape and sides of the neck is about 100 mm., considerably longer here than in the Shou. The ear is about $7\frac{1}{2}$ inches long from the notch to the tip in front and nearly $3\frac{1}{2}$ inches at its widest point. The gland on the hind leg is as nearly as may be the same distance from the hock as from the false hoof of the same side, namely just over eight inches, but this is probably due to unequal shrinking of the skin since in the photograph I published in 1912 (op. cit. p. 566) of a living *hanglu* the gland is clearly about a couple of inches nearer the hock than the false hoof. The general colour of the body and head is as described above; the white of the back of the thighs spreads on to the inguinal region and hind belly, the belly in front is blackish and there is some white on each side of the chest. The rump-patch extends about two inches in front of the root of the tail on each side, but the median dark dividing line runs backwards down the tail and expands behind so as to occupy the whole of its tip. In this respect the rump-patch differs markedly from that of the photograph of the living example I described in 1912, in which the dark band dividing the patch on the lower croup, stops short at the root of the tail, the upper surface of that organ being white like the buttocks on each side of it.

The antlers vary greatly individually in the curvature of the beam which may form part of the arc of a circle, as in a head from

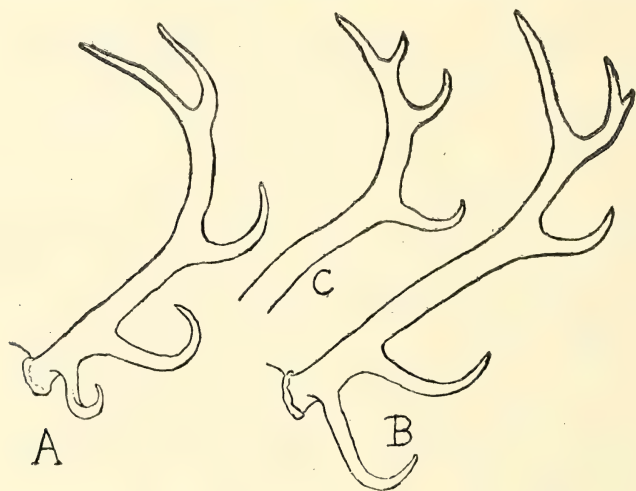


Fig. 5.—A, left antler of Hangul or Kashmir Barasingh shot above Manaspal Lake by Brig. Gen. Gillies; B, the same of one of Hume's examples from the Sind Valley; C, upper part of left antler of another of Hume's examples from the Sind Valley. (These three figures drawn from skulls, suspended several feet above the observer's eye).

'above the Manaspal Lake' (Brig. Gen. Gillies, no. 39.11) in which the inner terminal points are only $14\frac{1}{2}$ inches apart, whereas in

one of Hume's heads from the Sind Valley the beam is nearly straight from the burr to the terminal fork, exhibiting only a very slight deviation at the trez tine, the tips being $33\frac{1}{2}$ inches apart (no. 12.10.31.2). In another with the same history (no. 12.10.31.1) the portion of the beam between the bez and trez tines is slightly curved and the upward bend at the trez tine is more strongly marked.

Skull. There are many adult or approximately adult skulls in the British Museum; but only a few are complete in every respect.

They are very similar to the skulls of the Shou, but decidedly smaller. The longest from the Sind Valley (Hume, no. 12.10.31.1) has a total length of 404 mm. (about $16\frac{1}{5}$ in.) and a condylobasal length of 395 mm. ($15\frac{4}{5}$ in.), its total length being over 2 in. shorter than the longest skull of the Shou above recorded, and a little over 1 in. shorter than the shortest of that species; its condylobasal length is a little over 1 in. shorter than that of the only skull of the Shou, a medium-sized specimen, in which the condyles are preserved. Nearly as long as the Sind Valley specimen is a skull from above the Manaspal Lake (Brig. Gen. Gillies, no. 39.11) which has a total length of 399 mm., but a condylobasal length of only 373 mm.; a skull from the Lidar Valley (Lydekker no. 88.3.20.21) has a total length of 397 mm.; another from the Sind Valley (Hume, no. 12.10.31.2) is nearly the smallest in the collection, with a total length of 384 mm. and a condylobasal length of 365 mm., the former dimension being nearly one inch less than in Hume's longest from the same locality and the latter dimension over one inch less. The only other skull with a special locality is one from Srinagar (Capt. Phelps, not registered); this has the muzzle and occiput broken away,

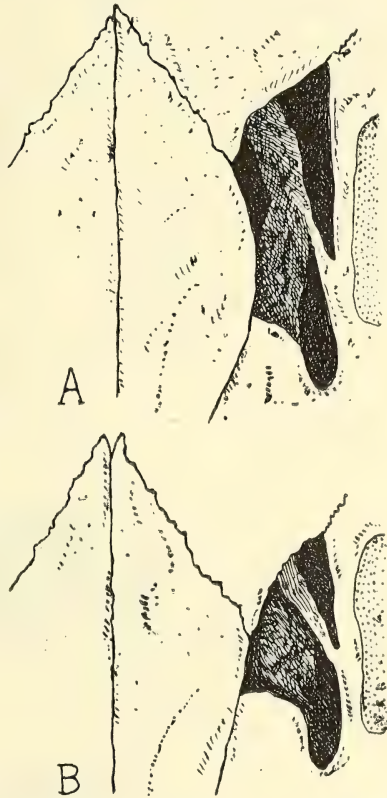


Fig. 6.—A, upper end of left nasal bone with vacuity and inner half of gland-pit (dotted), of Hume's Hangul from the Maharajah of Kashmir's Reserve, showing the longest area of contact between the nasal and the vacuity observed in the available skulls; B, the same of a skull from the Lidar Valley (Lydekker) showing the shortest area of contact.

but its available dimensions show nothing that calls for note. The average total length in six skulls is as nearly as may be two inches less than in the Shou; and the average condylobasal length of three

skulls is 378 mm., nearly two inches less than that of the only Shou in which that dimension is available.

In other skull-dimensions the two species frequently overlap or come very close to each other, as shown by the table of measurements. But on the average those of the Hangul are smaller with one notable exception which supplies the only cranial difference I can detect between the two species, apart from size.

The nasals vary in shape to about the same extent as in the Shou and their posterior angle may penetrate the frontals deeply enough to surpass considerably the posterior ends of the vacuities or may fall short of that point; but the free edge of the nasals, where they abut against the vacuities, is typically considerably longer than in the Shou mainly on account of the maxillae not extending so far posteriorly in contact with the nasals. Hence the anterior part of the vacuity bounded internally by the maxilla is generally considerably shorter than the posterior part bounded internally by the frontal. The length of the free edge of the nasal varies from about 27 mm. in a skull of Hume's from the Maharajah's Reserve (no. 91.8.7.2) to about 15 mm. in Lydekker's skull from the Lidar Valley (no. 88.3.20.1), its average in many skulls being about twice as great as in the Shou, although the nasals themselves are always shorter.

Genus *Przewalskium*, Flerov.

Przewalskium, Flerov, C. R. Acad. Sci. U.R.S.S., 1930, p. 115.

Type of the genus:—*Cervus albirostris*, Przewalski.

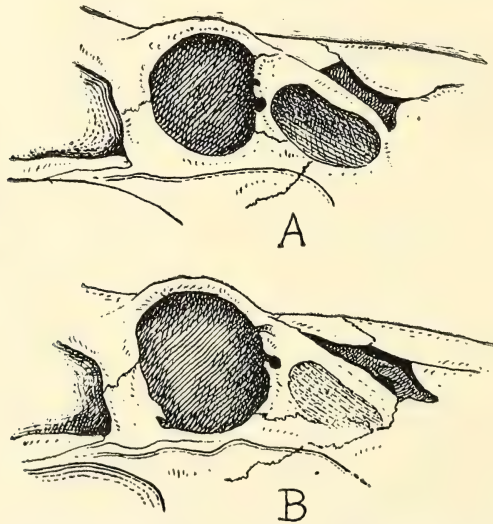


Fig. 7.—A, orbital region with vacuity and gland-pit of Przewalski's Deer (*P. albirostris*). Drawn from the skull of the type of *Cervus thoroldi*; B, the same of a skull of the Hangul (*C. hanglu*) from Srinagar (Phelps), showing particularly the shorter, shallower, less well defined gland-pit and larger vacuity in comparison with A.

Distribution:—Eastern Tibet.

Distinguished from the British Indian species of *Cervus* by the exceptional harshness of the coat, its reversal in growth—direction along the back either from its middle or from the croup (haunches) to the withers (shoulders) where it forms a well defined mat; by the narrower, more pointed, relatively longer ears; by the position of the gland-tuft nearer the false hoof than the hock of the hind leg; by the relatively shorter, broader hoofs; by the extension of the white of the upper lip over the muzzle, encircling the rhinarium, and that of the chin backwards over the whole of the lower jaw to the upper end of the throat, these white areas being sharply defined, and by the buff or fawn tint of the rump-patch, tail and backs of the thighs.

In the skull the gland-pit is much deeper, with more sharply defined edges, and relatively longer than in *Cervus*, its length a



Fig. 8.—A, the nasal bones, vacuities and inner half of the gland-pits (dotted) of Przewalski's Deer (*P. albirostris*) for comparison with figs. 4 and 6. Drawn from the skull of the type of *Cervus thoroldi*; B, right ear of the same drawn from the mounted type of *Cervus thoroldi*; C, the same of the Shou drawn from Col. Rennick's mounted specimen from the Chumbi Valley.

little exceeding the inside vertical diameter of the orbit; the vacuity, on the contrary, is much narrower and shorter, this peculiarity being associated with the immense width of the posterior portion

of the nasals which at their widest point between the vacuities are about half the total length of those bones and form on each side a bulging expansion with the convex free edge forming a long contact with the vacuity and its posterior border abruptly incurved transversely; the surface of the nasals in front of this expansion is scarcely appreciably constricted so that this area of the muzzle is flatter transversely than in *Cervus*; the anterior nares also are relatively wider and shorter.

The antlers exhibit an obtusely angular backward bend at the level of the 'trez' tine; the two terminal tines form a longitudinal not a transverse fork as in *C. hanglu* and *affinis* and the 'bez' tine is undeveloped. It is normally of large size in the British Indian representatives of *Cervus* but it may be absent as a racial or individual peculiarity in the type of the genus *C. elaphus*.

Most of the characters of this stag have been previously described. The generic diagnosis here given is taken from the type of *Cervus thoroldi* represented by the mounted skin and the skull in the British Museum. The differences pointed out seem to justify the generic rank given to the species by Flerov. He, however, enumerated as distinctive of *Przewalskium* a large number of additional cranial features. Like myself he appears to have had only one skull. It is not clear with what skulls of *Cervus* he compared it and he gave no measurements. But comparison between the skull of the type of *thoroldi* and skulls of *Cervus hanglu* fails to substantiate many of the differences he claimed and shows some noticeable individual differences between the skulls of *albirostris* that he and I examined.

Flerov claimed that in his skull:—(1) the width is half the length; (2) the anterior edge of the mesopterygoid fossa reaches the line of the last molars, whereas in *Cervus* it falls far short of that line; (3) the palate is broad and flat, unlike the concave, roof-like palate of *Cervus*; (4) the bulla is comparatively minute and the external auditory meatus is thin and without the sharply marked crest seen in *Cervus*; (5) the teeth are minute (small) as compared with those of *Cervus* and the tooth-row is short and flat, whereas in *Cervus* it is 'curved archwise downwards' that is to say the crowns of the molars in profile view form a convex curve, the median teeth being lower than the anterior and posterior of the series.

In the skull of the type of *thoroldi*:—(1) the width is much less than half the length, falling short of it by 40 mm. (over $1\frac{1}{2}$ inches); (2) the anterior edge of the mesopterygoid fossa is on a level with the middle of the last molars; in one skull of *Cervus hanglu* (Harrington) it overlaps the last molars by about one-third of their length, in another (Duke of Bedford) it falls short of the line of the molars by about 2 mm. only; (3) the palate is 'concave and roof-like', as in the two skulls of *C. hanglu* cited; (4) the bulla is larger than in the Duke of Bedford's skull of *hanglu*, in which it looks shrunken, and the crest on the meatus forms a definite ridge, although not so well developed as in that skull of *hanglu*, which is considerably older. I attribute the strong crest and shrunken bulla in this specimen to age; (5) the individual teeth are a trifle smaller for the most part than in Harrington's skull of *hanglu*, the actual length

measurements in mm., with those of the *hanglu* in brackets, being as follows:— pm^1 15 (17), pm^2 15 (17), pm^3 15 (15), m^1 20 (21), m^2 23 (25), m^3 22 (24), total length of the row 107 (112). But in the Duke of Bedford's older skull of *hanglu*, with the teeth worn, the same measurements are: 17, 16, 14, 16, 19, 22, 100; in Mrs. Abbey's skull of *hanglu*, with the teeth unworn, they are 16, 16, 15, 20, 22½, 21½, 109 and in Phelps's skull from Srinagar the last four teeth are 15, 18, 22, 24, the total, including the first two missing premolars, being 114. Clearly the teeth vary in size individually in *hanglu*. They also vary in *Cervus elaphus*. In a skull from Coto Donana, Spain, the measurements are 15, 15, 14, 19, 22, 21, 100 and in one from Balmacaan, Scotland, they are 14, 14, 14, 17, 22, 19, 99. In both the teeth are smaller than in the type of *thoroldi*.

Przewalskium albirostris, Przewalski.

Cervus albirostris and *sellatus*, Przewalski, Reise Tibet, pp. 73 and 76, 1884 and Cat. Zool. Coll. p. 16, 1887; Pousargues, Bull. Mus. Paris, 1897, p. 284 and Mem. Soc. Zool. Fr., 11, p. 215, 1898; Pocock, Proc. Zool. Soc. 1912, p. 574, Lydekker Cat. Ung. Brit. Mus., p. 149, fig. 28, 1915 and several of his earlier publications.

Cervus dybowskii, W. L. Sclater, Journ. As. Soc. Beng. 58, pt. 2, p. 186, pl. 11 (skull), 1889; Bentham, Cat. Asiatic Horns, etc. Ind. Mus., p. 64, pl. (skull), 1908 (not of Taczanowski 1876).

Cervus thoroldi, Blanford, Proc. Zool. Soc. 1893, p. 444, pl. 34, text fig.

Przewalskium albirostris, Flerov, C. R. Acad. Sci. U.R.S.S., 1930, p. 115; Pocock, Proc. Zool. Soc. 1933, p. 385.

Locality of the type of *albirostris* and *sellatus*: Nak, Chan (Nan. Chan) N.-E. Tibet; of *thoroldi*, N.-W. of Bethany, 200 miles N.-E. of Lhasa, Tibet.

Distribution:—E. Tibet.

The first Englishman to describe this rare species was W. L. Sclater who had in the Calcutta Museum a head-skin and skull found in the Darjiling bazaar. This with much hesitation and, as it proved, erroneously, he identified as *Cervus dybowskii*, one of the *Sika*-group inhabiting the Ussuri district of Manchuria. He pointed out the main peculiarities of the skull, distinguishing it from those of the larger Indian species of the family and gave some measurements in English inches which show a few minor differences from those of the type of *thoroldi*. The only two which call for notice are the condylobasal length which is $13\frac{3}{4}$ inches, about $\frac{1}{2}$ inch shorter, and the orbital width which is $7\frac{1}{2}$ inches, $\frac{3}{4}$ inch wider, a surprising difference.¹ Blanford's coloured plate of the

¹ Sclater's words were 'greatest width behind the orbits' from which I infer he meant 'greatest width of the orbits behind', the orbital width being the greatest width in the type of *thoroldi*. Bentham's measurements of the same skull nearly twenty years later are hopelessly at variance with Sclater's. The basal length, according to him, is $15\frac{1}{4}$ inches, considerably longer, instead of shorter than the condylobasal length. No doubt he meant the total length, since the total length of the skull of the type of *thoroldi*, is just under $15\frac{1}{2}$ inches. The width, according to Bentham, is $5\frac{3}{4}$ inches, about one inch less than in that type.

type of *thoroldi* is a good representation of the specimen, except that the ears are manifestly much too short; but he also gave a woodcut of the head of a second specimen shot by Thorold. This specimen I have not seen; but the ears in the figure of it are much longer than those depicted in the plate and resemble those of the actual type. Hence the evidence that the ears in the two known specimens of *thoroldi* are longer, narrower and more pointed than in Wallich's deer, the Shou and the Kashmir Barasingh is satisfactory.

Blanford perceived that his specimens of *thoroldi* were specifically the same as the stag Sclater had described four years previously; but it was Pousargues who detected that Przewalski had previously named the species *albirostris*.

There is one other point. Blanford discussed at some length his suspicion that Hodgson in 1851 had described *thoroldi* as *nariyanus*. He finally rejected that name because of its alleged inappropriateness, without perceiving that Hodgson's figure of the antler of *nariyanus* at once negatives the supposition.

The only available specimen is the type of *thoroldi*, a mounted skin collected at Bethany, 200 m. alt. by W. C. Thorold (no. 92.10.11.1). It is a strongly built stag, the standing height at the withers being about 48 in. and the length over the curves to the root of the tail, only $72\frac{1}{2}$ in., just over 6 ft., the same height approximately as a mounted skin of *C. hanglu* alongside it, but 7 in. shorter in the length of the head and body. Whether this difference in length is a genuine character or due to artificial preparation is doubtful. The coarse hairs on the body are straight and about 52 mm. (2 in.) long, but on the fore part of the shoulder-mat they are curved and 73 mm. (about 3 in.) long; those on the muzzle and cheeks as far back as below the ears are much finer and smoother. The general colour is darkish brown, with a fulvous speckle in the pelage; this gradually fades to sandy fawn on the legs; the white on the head, throat and front of the ears is much more sharply defined than in the Shou and Hanglu (Kashmir Stag) and the rump patch and tail are sandy like the legs and sharply defined from the brown of the back and outside of the thighs; the patch extends about 3 in. in front and at the sides of the tail, which is about $5\frac{1}{2}$ in. long, without the terminal hairs. The noticeably pointed ears are $8\frac{1}{2}$ in. long from the notch in front, 10 in. from the base behind and 3 in. wide in the middle of their length; they are actually longer and narrower than in the mounted specimen of the Hanglu. The gland on the hind leg is below the middle of the shank, its centre being $8\frac{1}{2}$ in. below the hock and 7 in. above the outer false-hoof. The main hoofs are about 60 mm. long down the front edge.

In this account I have followed the general opinion that *thoroldi* is a synonym of *albirostris*. The names admittedly apply to the same species; but they may symbolise distinct subspecies. At all events, according to the descriptions, the types differ in two respects and were killed at places some 600 miles apart. From Przewalski's description of *albirostris*, of which Pousargues published

a translation, the hairs along the spine in *albirostris* are reversed from the middle of the back and the general colour is 'brownish red', each hair being brown at the base, red at the tip; and the under side and the inner sides of the upper half of the limbs are clearer red. In the type of *thoroldi*, on the contrary, the spinal hairs are reversed from the croup and there is no red in the pelage, the tips of the hairs of the upper side being pale fulvous and the general colour of the body above and below brown. But the difference in the spinal hairs may be merely individual and the difference in colour seasonal, the type of *albirostris*, with the antlers in velvet, having been shot in July and that of *thoroldi*, with the antlers burnished, in the snow, presumably of winter.

In the following table of measurements the length of the face is taken from the anterior rim of the orbit to the tip of the muzzle; the orbital width across the upper half of the orbit behind above the zygomatic arch; the height of the facial vacuity is taken from the middle of the free edge of the nasal to the nearest point of the lower edge of the vacuity. The exact dimensions of the gland pit are doubtful owing to the anterior and lower edges being sloping and ill defined. It must also be explained that the numbers in the successive columns do not necessarily apply to the same stag. They represent the largest and smallest dimensions of the areas mentioned shown by the series of skulls of the Shou and Hanglu. This of course does not apply to Przewalski's stag, of which only a single skull is available.

Some dimensions in mm. of the largest and smallest skulls, of parts of a number of skulls and the averages of the same, of the Shou and Hanglu and of the single example of *Przewalski's Deer* in the British Museum.

	Total length.	Length of face.	Orbital width.	Width of muzzle above canines.	Height of orbit inside.	Length and greatest width of nasals.	Length of edge of nasal bordering vacuity.	Length and height of vacuity.	Length and height of gland pit.
Shou (<i>C. affinis</i>)									
Largest ...	460	365	194	88	57	188 : 73	17	72 : 27	47 : 37
Smallest ...	433	240	173	75	51	164 : 55	6	58 : 17	43 : 28
Average of 6 ...	446	254	188	83	54	175 : 65	9	64 : 20	45 : 33
Hanglu (<i>C. hanglu</i>)									
Largest ...	404	237	182	77	54	160 : 60	27	57 : 24	46 : 32
Smallest ...	384	205	160	65	49	120 : 47	15	47 : 18	35 : 23
Average of 6 to 10 ...	395	221	172	71	51	140 : 54	18	54 : 20	38 : 27
Przewalski's Deer (<i>P. albirostris</i>)									
...	384	208	172	73	48	151 : 78	35	40 : 9	51 : 21

SUMMARY.

The distinguishing characters of the four species above described may be summarised as follows:—

External characters, apart from the antlers.

- a. Ears wider, less pointed; gland-tuft on hind leg nearer the hock than the false hoof; coat not so harsh, directed backwards along the spine without forming a mat on the withers; muzzle not encircled with white, under side of lower jaw and summit of throat not so conspicuously white; rump-patch and backs of thighs white ... *Cervus*
- b. Rump-patch extensive, reaching summit of croup, without median dark stripe (other characters as in *affinis*, but dark brown colour phase unknown) *wallichii*
- b.¹ Rump-patch much smaller, narrower and not extending over one-third of the distance to the summit of the croup, always marked with a more or less distinct median dividing dark stripe.
- c. Size larger, height about 52 in., at withers, rump-patch with a thin, sometimes abbreviated median stripe; general colour varying from deep brown to fawn grey; chin and lips fawn, not very sharply contrasted with the rest of the face; no white on lower jaw *affinis*
- c.¹ Size smaller, about 48 in. at withers; rump-patch with a broad stripe dividing it at least to the root of the tail but sometimes extending to the tip of that organ; general colour apparently deep brown at all seasons, no pale phase recorded; chin and lips white, sides of muzzle pale fawn rather sharply contrasted with the rest of the face; some white on lower jaw and belly ... *hanglu*
- a.¹ Ears narrower, more pointed; gland tuft on hind leg nearer the false hoof than the hock; coat very harsh, directed forwards along the whole of the spine or from its middle to the withers, where it forms a

definite mat; white from the upper lip extending over the muzzle behind the rhinarium, lower side of the under jaw and upper end of the throat white and conspicuously contrasted with the surrounding area; rump-patch, tail and backs of thighs fawn

*Przewalskium
albirostris*

Skull characters, those of *C. wallichii* unknown.

- a. Median portion of nasals compressed, their lateral edges gradually expanding posteriorly towards the facial vacuities, their greatest width always less than half their greatest length; vacuities long and wide; gland-pit comparatively shallow and short, their length less than the vertical diameter of the orbit; anterior nares relatively longer and narrower *Cervus*

- b. Skull larger, about 2 in. longer, free edge of nasals abutting against the vacuities typically very short, averaging about 9 mm. *affinis*

- b.¹ Skull smaller; free edge of nasals abutting against vacuities not so short, averaging about 18 mm. *hanglu*

- a.¹ Median portion of nasals noticeably flatter, their lateral edges curving abruptly outwards towards the vacuities forming a wide expansion about half the total length of the nasals and reducing the size of the vacuities which are rather short and particularly narrow; glandpits deeper and longer, their length slightly exceeding the vertical diameter of the orbit (inside measurement); anterior nares relatively wider and shorter *Przewalskium
albirostris*

THE BIRDS OF MYSORE.

BY

SÁLIM ALI.

With notes by Hugh Whistler.

PART II.

(Continued from Vol. xliii, No. 2, p. 147).

Garrulax delesserti (Jerdon) The Wynaad Laughing Thrush.

Specimens collected: 834 ♂, 835 ♀ 5-2-40, 850 ♂, 851 ♂ 852 ♂ 8-2-40 Agūmbē (2,500').

Elsewhere not noted.

[Measurements:

	Bill	Wing	Tail
4 ♂♂	29.5-30.5	107-113.5	99-107 mm.
1 ♀	31	113	106.5 mm.—H. W.]

This Laughing Thrush was met with only at Agūmbē. Flocks of 12 to 15 individuals skulked about squeaking shrilly in dense evergreen undergrowth with a profusion of cane brakes and palms.

The testes of all the 3 specimens of 8 February were enlarged. They measured 12×7, 9×5 and 8×5 m.m. respectively.

No Laughing Thrushes of the genus *Trochalopteron* were noted in Mysore.

Turdoides somervillei orientalis (Jerdon) The Eastern Ghāts Jungle Babbler.

Specimens collected: 163 ♀ 24-11-39 Maddūr (2,500'); 406 ♀ 21-12-39 Māklidrūg (2,800'). *Biligirirangan Hills*: 40 ♂ 10-11-39 (4,000' Bedagūli); M70(H) ♀ 10-4-34, M30(H) ♂ 10-5-34 (5,000'); M63-64(H) ♂ ♀ 15-5-34 (4,000' Shenemenhalla).

Elsewhere noted: Bandipūr, Devarbetta Hill, Sātnūr, Thōndēbhāvi, Nāmadachilumē, Saklēshpūr, Jāgar Valley (2,500'—Bābābūdan Hills), Settihalli.

Common in deciduous biotope and partial to bamboo facies. At Bandipūr, Maddūr and Sātnūr this species was frequently observed inhabiting the same patch of jungle as *T. striatus affinis*, and at Nāmadachilumē once actually in association with it.

Specimen No. 163 (24 November) was preparing to breed. Its largest ovum was over 2 mm. in diameter.

Turdoides striatus affinis (Jerdon) (= *polioplocamus* Oberholser.) The White-headed Babbler.

Specimens collected: 79 ♂ 15-11-39 Bandipūr (3,300'); 374 ♂ 17-12-39 Sātnūr (2,500'); 548 ♂ 7-1-40 Marikānivē (2,500'). *Biligirirangan Hills*: M16 (G) ♂ 9-7-34 (3,000' Udahatti, Eastern base).

Elsewhere noted: Maddūr, Hūnsūr, Nandidrūg, Dodballapūr, Kolār Gold Fields.

[Measurements:

	Bill	Wing	Tail
4 ♂♂	20.5-22	105-109.5	97-104 mm.

This is the correct name for the White-headed Babbler which has been called *Turdoides striatus polioplocamus* in the previous surveys, as Oberholser's name is ante-dated by *Malacocercus affinis* Jerdon, *Ill. Ind. Orn.* (1847) pl. 19. —H. W.]

Common. Inhabits drier and more open low scrub country than the Jungle Babbler, commonly on the outskirts of cultivation and about human habitations. The two species are frequently found side by side and sometimes even in association where their respective preferences overlap.

All the 3 survey specimens had enlarged gonads (11×6, 10×5, 9×6 mm.) and they were either breeding or about to breed.

Argya caudata caudata (Dumont) The Common Babbler.

Specimens collected: 375 ♂ 17-12-39 Sātñūr (2,500'); 501 ♀ 10-1-40 Marikānivē (2,500').

Elsewhere not noted.

Uncommon and patchily distributed in the Maidān. Found in dry, open scrub-and-bush country—practically semi-desert.

Both the specimens appeared to be breeding. The male's testes measured 14×5; the largest ovarian follicle of the female was 10 mm. in diam. and the oviduct greatly distended.

Argya malcolmi (Sykes) The Large Grey Babbler.

Specimens collected: 315 ♀, 316 ♂ 13-12-39 Sātñūr (2,500').

Elsewhere noted: Marikānivē.

Uncommon and patchy in the Maidān. Its distribution in Mysore State is more or less coincident with that of the Common Babbler. They are both birds of dry, open, sparsely scrubbed country with cultivation interspersed.

Argya subrufa (Jerdon) The Rufous Babbler.

Specimens collected: 233 ♂, 234 ♀, 235 ♂ 2-12-39 Manchgowdanhalli (2,500'); 264 ♀ 4-12-39 Kārāpūr (2,500'); 637 ♂ 15-1-40 Saklēshpūr (3,000'). *Biligirirangan Hills*: M83-85(H) ♂ ♂ ♂ 13-5-34 (4,000' Anaribetta).

Elsewhere noted: Settihalli.

[Measurements:

	Bill	Wing	Tail
6 ♂ ♂	21-23.5	89-94.5	115-118 mm.
2 ♀ ♀	21-22	90-91	105 mm.—H. W.]

Probably more generally distributed than the above records indicate. Its preferential habitat is the intermediate zone. Here it affects dense scrub undergrowth and thickets, particularly where intermixed with tall coarse grass and bamboo brakes. Through the spiky tangles of these (*B. arundinacea*) the birds scuttle in and out and up the stems with the agility of a mouse. A shrill continuous *tree..tree..tree* whistling is kept up. In timbre and volume it is like the chirping of a large cricket, but broken now and then by one or two tell-tale harsher squeaks. The whistling is frequently kept up unbroken for quite 10 seconds at a stretch. Its harsh squeaky alarm notes are the typical 'babbling'.

The gonads of a male on 2 December were enlarged to 7×5 mm. The ovaries of females both on that date and on 4 December were conspicuously granular. Two of the 2 December specimens had distinct incubation patches and all 3 were undergoing complete moult—body, wings and tail—so presumably post-nuptial.

Pomatorhinus horsfieldi horsfieldi Sykes. Horsfield's Scimitar Babbler.

Specimens collected: 117 ♀ 19-11-39, 169 ♂ 25-11-39 Bandipūr (3,300'); 132 ♀ 21-11-39 Gūdalūr Ghāt (4,500'); 206 ♂ 30-11-39 Antarsāntē (2,500'); 607 ♂ 13-1-40, 629 ♂, 630 ♂ 14-1-40, 652 ♂ 16-1-40 Saklēshpūr (3,000'); 685 ♂ 20-1-40 Kemmangūndi (5,000'—Bābābūdan, Hills). *Biligirirangan Hills*: M28(H) ♀ 12-3-34, M50(G) ♂ 30-10-34 (5,000' Honnametti); M54(H) ♂ 14-4-34, M60(H) ♀ 24-4-34, M101-103(H) ♂ ♀ ♀ 22-5-34 (4,000' Bellaji); M37(G) ♂ 22-9-34 (2,000' Satyamangala); M46(G) ♀ 28-10-34 (4,000' Attikān).

Elsewhere noted: Nandidrūg, Nāmadachilumē, Jōg.

[Measurements:

	Bill	Wing	Tail
11 ♂ ♂	29.5-33	95.5-104	95-117 mm.
4 ♀ ♀	29.5-33	93.5-96	93-100 mm.
2 ♀ ♀ (juv.)	—	85.5-89	93-98 mm.

The question of the races of this Scimitar Babbler first attracted my attention in the Eastern Ghats Survey (*J.B.N.H.S.*, xxxv, pp. 741-742) with the eventual result that in *J.B.N.H.S.*, xxxviii, p. 699 I named a new race *P. h. maderaspatensis* from the lower Eastern Ghats. Under the latter reference I also pointed out that the above series of birds collected by the interest of Mr. R. C. Morris in the Biligirirangan Hills belonged to the typical race, birds with a long bill and a marked black edge to the plastron. At the time this identification was made it appeared a somewhat bold one as the Biligirirangans were a long way south of Castle Rock (near Goa), the most southerly locality from which I had then seen the typical race, and in this new locality the typical race appeared to be sandwiched in between *P. h. travancorensis* of the Malabar Coast and *P. h. maderaspatensis* of the lower Eastern Ghats. This new series collected by Mr. Sâlim Ali, however, not only fully confirms the identification but with its new localities does much to lessen the gap, and it is clear that in southern India we have the three races with a parallel distribution in the Western Ghats, central plateau and Eastern Ghats respectively. Viewed in series the three races are very distinct. It will be noticed that the Gudalur Ghât bird is similar to the rest of Mr. Sâlim Ali's series though Nilgiri birds generally are accepted as *travancorensis*.—H. W.]

The Scimitar Babbler is common in all the well-wooded portions of the State both in the evergreen and deciduous biotopes and up to the highest hills. The birds were usually met with in pairs calling and answering one another. All the Survey specimens were more or less sexually mature, and breeding was certainly in progress between mid-November and mid-January. No nest was actually found in Mysore, but at Hebbalē (a few miles from Sakleshpur, across and within the Coorg border) F. N. Betts found one at the base of a *Lantana* bush on an open deciduous hillside containing one chick and 1 addled egg (ca. 10 January). The nest was the usual ball of leaves and bast fibres.

Dumetia hyperythra albogularis (Blyth) The Small White-throated Babbler.

Specimens collected: 108 ♂ 19-11-39 Bandipūr (3,300'); 363 ♀ 17-12-39 Sâtnūr (2,500'); 387 ♀ 19-12-39 Mâklidrüg (2,800'); 556 ♀ 7-1-40 Marikanivē (2,500'). *Biligirirangan Hills*: 54 ♂ 11-11-39 (4,000' Dodsampagi); 0? imm. 30-12-32 (Honnametti 5,000'); M26(H) 0? 13-3-34 (4,000' Attikân); M62(H) ♂ 15-5-34 (4,000' Shenemenhalla); M92-95(H) ♂, 0? juv., ♀ ♂ 19-5-34 (4,000' Magoolibetta); M44(G) ♀ 17-7-34 (3,000' Udahatti).

Elsewhere noted: Herikerē, Châmüdi Hill, Nandidrüg, Kemmangüdi (Bâbâbûdâns).

[Measurements :

	Bill	Wing	Tail
5 ♂ ♂	13-14.5	56-59.5	61-62.5 mm.
4 ♀ ♀	13.5-14	55-56	59-63 mm.—H. W.]

Common in deciduous scrub jungle with thorn thickets of *Zizyphus rugosa* and others, intermixed with tall coarse *Andropogon* grass. On the Biligirirangans where dense evergreen *sholas* in the ravines alternate with open grass and scrub deciduous patches, this little babbler is strictly confined to the scrub and thickets on the open hilltops and ridges separating the nullahs. It ventures into the undergrowth on the fringe of the intermediate zone, but steadfastly avoids evergreen.

Chrysomma sinensis sinensis (Gmelin) The Yellow-eyed Babbler.

Specimens collected: 221 ♂ 1-12-39 Antarsântē (2,500'); 300 ♂ 9-12-39 Hünsūr (2,000'); 317 ♂ 13-12-39 Sâtnūr (2,500'); 512 ♂ 31-12-39 Nâmadachilumē (3,000') *Biligirirangan Hills*: M104(G) 30-7-34, M112(G) 0? 3-8-34 (3,000' Udahatti).

Elsewhere noted: Bandipūr, Herikerē, Hangala, Gündlûpet, Châmüdi Hill, Thôndēbhâvi.

[Measurements :

	Bill	Wing	Tail
5 ♂ ♂	14-14.5	67-70	80.5-88.5 mm.
1 ♀	14.5	67.5	87 mm.—H. W.]

Resident. Common. Confined to deciduous biotope. Frequents thorn thickets intermixed with tall coarse grass—very similar facies to that of *Dumetia*.

Major Phythian-Adams has two clutches of 4 eggs each taken on 12 and 13 June near Gündlupet.

Pellorneum ruficeps ruficeps Swainson. The Spotted Babbler.

Specimens collected: 672 ♂ 19-1-40 Bābābūdan Hills (4,500'—Kemmangūndi); 770 ♂ 29-1-40, 787 ♂ 31-1-40 Settiballi (2,500'). *Biligirirangan Hills*: M₁₂ (G) ♂ 15-9-34 (2000' Satyamangala).

Elsewhere noted: Bandipūr, Kārāpūr, Antarsāntē, Shimsha, Sivāsāmūdrām, Devarbetta Hill, Nāmadachilumē, Saklēshpūr.

[Measurements:

	Bill	Wing	Tail
3 ♂♂	18.5-19	70-74	66-69 mm.

The Biligirirangan bird has juvenile wings (68.5) and tail (65), so is not included in the above.—H. W.]

Common and generally distributed in the wooded portions of the State, chiefly in the mixed intermediate zone between the evergreen and deciduous biotopes. Sporadic bursts of song may be heard at all seasons. During the Survey (November to March) the bird was mostly silent, and only uttered the monotonous *Pretty-sweet* or *Beat-you* notes. These were heard chiefly up to about 9.30 in the morning, and then from about 5 onwards until dusk. They are repeated continuously at intervals of 5 seconds or so for over 15 minutes at a stretch from up within the thickest bamboo brakes and clumps. When approached after infinite struggling through the thickets, the calls suddenly cease. Sometimes, but not always, a subdued harsh *chr-r*, *chr-r* intimates that the bird is slinking off, and the aggravating plaint recommences a hundred yards or so further!

No precise evidence as to the breeding season in Mysore was obtained.

Mixornis gularis rubricapilla (Tickell) The Yellow-breasted Babbler.

Specimens collected: 207 ♂, 208 ♀ 30-11-39 Antarsāntē (2,500'); 232 ♂ 2-12-39 281 [♂] 6-12-39 Manchgowdanhalli (2,500').

Iris yellowish-white.

Elsewhere not noted.

[Measurements:

	Bill	Wing	Tail
3 ♂♂	15.5-16	62-63	18-20 mm.

The ♀ is in complete moult with a broken bill so no measurements possible.

This is one of the most interesting discoveries of the Survey as it greatly extends the known distribution of the species and race. In the Eastern Ghāts Survey (*J.B.N.H.S.*, xxxv, p. 747) it was found to be common in the Vizagapatam area and this was a slight extension of the known range, southwards at the time. This further extension was quite unexpected, and even Jerdon never hinted that the bird might be found in South India. The specimens are quite indistinguishable from Vizagapatam and Himalayan specimens.—H. W.]

The Yellow-breasted Babbler was met with in a small patch, about $\frac{1}{2}$ mile square, of deciduous bamboo jungle on the bank of the Kabani river. Though the specimens are labelled differently as to locality they were all obtained within this same patch. Antarsāntē is about 3 miles distant from Manchgowdanhalli and a better known village than the latter, which is merely a Forest Department's timber depot.

Two or three small parties of these birds, each of 3 or 4 individuals, were observed keeping high up in the bamboo clumps—usually above 15 ft.—clinging to the foliage upside down and sideways, searching for insects on the under-surface of the leaves and moving from clump to clump. Their actions were strongly reminiscent of both the Iora and the Tit. The call—a rich *kew-kew-kew-kew-kew* repeated for several minutes with short breaks in between, is rather like that of the Tailor Bird, but louder and with something of the richness of a Blackbird's song. It is a big noise for so small a bird. This *kew-kew* calling is occasionally varied by a sharp *chr-r-r* as of the Spotted Babbler.

All the specimens were completing moult—body, rectrices and remiges. Their gonads were quiescent.

***Alcippe poiocephala brucei* Hume.** The Bombay Quaker Babbler.

Specimens collected: 213 ♂ 30-11-39, 282 ♀ 6-12-39 Manchgowdanhalli (Antarsantē 2,500'); 673 ♀ 19-1-40, 697 ♂ 21-1-40 Babādūdan Hills (4,500'—Kemmanḡūndi); 749 ♀ 27-1-40 Settihalli (2,500') *Biligirirangan* hills: 7 ♂ 6-11-39, 26 ♂ 9-11-39 (4,000'—Edbūthi); ♂ 16-12-32, ♀ 17-12-32, M16(H) ♂, M28(H) ♂ juv. 9-5-34, M56(H) o? 14-5-34, M30(G) ♀ 20-10-34 (5,000'—Honnametti); M57(H) ♀ 19-4-34, M26(G) ♂ 18-10-34 (4,000'—Shenemenhalli); M78(H) ♀, M100(H) ♂, M107(H) ♂ —5-34 (4,000'—Attikān); M61(H) ♂ 15-5-34 (4,000'—Bellaji).

Elsewhere noted: Saklēshpūr, Jāgar Valley, Jōg.

[Measurements:

	Bill	Wing	Tail
11 ♂ ♂	15-17	68.5-74.5	61.5-69 mm.
10 ♀ ♀	15.5-16.5	66-71	62-64.5 mm.
1 ♂ juv.	—	66	65.5 mm.

All the specimens collected by the Survey clearly belong to the race *brucei* including the 2 marked from the Biligirirangans (Edbūthi). Whether this is a mere chance of individual variation as regards the 2 latter, or whether they come from a distinct area is not clear, but the original Biligirirangan series (M) are all intermediates between *poiocephala* and *brucei*, being definitely more richly coloured than the Survey series.—H. W.]

A common and abundant resident species of evergreen biotope, extending across the intermediatē zone to the fringe of deciduous, especially the bamboo facies.

Flocks, of 6 to 10 birds mostly, were met with amongst undergrowth as well as in forest canopy. I have nothing to add to its habits as described in the Travancore report (*J.B.N.H.S.*, xxxviii, 80). Amongst leafy bamboo stems its actions and appearance are very like *Mixornis*. My field-book records that the last note in the call of the Antarsantē and other Mysore birds was somewhat different—more prolonged and interrogative than that of the Biligirirangan birds.

All the Survey specimens except No. 7 showed progressive gonadal development. No. 213 (30 November) and 697 (27 January) with testes measuring 8×6 and 8×5 mm. respectively, as well as the females collected round these dates certainly appeared to be getting ready to breed.

***Rhopocichla atriceps atriceps* (Jerdon)** The Black-headed Babbler.

Specimens collected: 284 ♂, 285 ♂, 286 ♀ 6-12-39 Manchgowdanhalli (Antarsantē 2,500'); 664 ♂ 17-1-40 Saklēshpūr (3,000'); 750 ♀ 27-1-40, 809 ♂ 2-2-40 Settihalli (2,500') *Biligirirangan* Hills: 1 ♂ 6-11-39, ♀ 17-12-32, ♂ 19-12-32, M17(H) o? 9-5-34, M48-49(H) ♂ ♀ 12-5-34, M3(G) o? 9-10-34, M27(G) ♂ 19-10-34 (Honnametti, 4,5,000'); M114(H) ♂ 25-5-34 (Edbūthi, 4,000').

Elsewhere noted: Bābādūdan Hills (Kemmanḡūndi), Jōg.

[Measurements:

	Bill	Wing	Tail
10 ♂ ♂	14.5-16	58.5-61	48.5-52.5 mm.
5 ♀ ♀	14.5-16	55-58.5	45-48 mm.—H. W.]

Resident. Common in evergreen biotope. Flocks of 6 to 8 amongst dense undergrowth of seedlings and *Strobilanthes*. Particularly fond of cane brakes in dank ravines. Hopping about amongst the stems and rarely exposing themselves. Seldom ascending into forest canopy.

Observed on one occasion in bamboo facies of dry-inter belt.

Two of the specimens of 6 December showed a slight gonadal development. Testes 4×3 mm.; largest ovum 1.5 mm. It is probable that as in many members of this family the breeding season is ill-defined and straggles over most of the year.

Agithina tiphia humei Stuart Baker. The Central Indian Iora.

Specimens collected: 84 ♀ 17-11-39, 100 ♂ 18-11-39, 106 ♀ 19-11-39 Bandipūr (3,300'); 344 ♀ 15-12-39 Sātūr (2,500'); 560 ♂ 7-1-40 Marikānivē (2,500'); 823 ♂ 4-2-40 Agūmbē (2,500'); *Biligirirangan Hills*: M1-2(G) ♂ ♀ 7-7-34, M40(G) [♂] (3,000'—Udahatti, E. base); M8(G) ♂ 15-9-34 (2,000'—Satyamangala); M38(G) ♂ 23-10-34 (3,000'—Bellāji).

Elsewhere noted: Hūnsūr, Shimsha, Thōndēbhāvi, Nāmadachilumē, Jōgi-maradi, Saklēshpūr, Settihalli, Kolār Gold Fields.

[Measurements:

	Bill	Wing	Tail
7 ♂ ♂	16-18	(once 58.5)	64-68
6 ♀ ♀	17-18	66-67.5	(once 42.5) 47.5-50 mm. 51-56 mm.

One of the *Biligirirangan* birds, ♂ 15 Sept. 1934 from Satyamangala (2,000') and evidently by the softness of the skull and the narrow tail feathers an immature bird, could not be distinguished from *Æ. nigrolutea* as the central tail is washed with white. I cannot believe that this is really *nigrolutea* which has not been recorded from nearer than northern Khandesh and Sambalpur. It is evidently an interesting case of individual variation showing how *nigrolutea* had its origin.—H. W.]

Resident. Confined to deciduous biotope. In localities like Saklēshpūr and Agūmbē (in Malnād) where there is an intermingling of the deciduous and evergreen types of vegetation, the Iora was invariably found in the deciduous facies, keeping to thin jungle and scrub. It was commonly met with as a member of the localised forest associations or hunting parties of insectivorous birds.

Courtship was in general progress about the middle of December at which season males in full breeding plumage were to be seen. Breeding in many cases appeared to be imminent. No. 344 (15 December) had a conspicuously granular ovary.

Chloropsis aurifrons frontalis (Pelzeln) The Gold-fronted Chloropsis.

Specimens collected: 78 ♂ 15-11-39, 107 ♀ 19-11-39 Bandipūr (3,300'); 865 ♂, 866 ♀ 12-2-40 Jōg (2,000').

Elsewhere noted: Karapūr.

. [Measurements:

	Bill	Wing	Tail
1 ♂	24	100	71 mm.
2 ♀ ♀	23	88.5-91.5	64-67.5 mm.
1 ♂ juv.	—	91.5	67.5 mm.

On the western side of India there is a gradual transition in size between the larger bird *frontalis* and the smaller more southern *insularis*. In the Eastern Ghats Survey (*J.B.N.H.S.*, xxxv, 751) it will be remembered that I suggested that the Pālghāt Gap might conveniently be fixed as the boundary between the two forms. These specimens support that suggestion.—H. W.]

Resident. Not uncommon. Typical of deciduous biotope, but rarely also entering the mixed intermediate zone. Teak plantations constitute a favourite haunt of this species.

The pair (865 and 866) obtained on 12 February were breeding. Testes of ♂ 7×4 mm.; largest ovum of ♀ 4 mm. The oviduct was much distended indicating that eggs had been laid. In this breeding pair the disparity in the development of the gonads seems noteworthy. I have remarked upon a similar disparity in the case of a pair of Frogmouths in Travancore (*J.B.N.H.S.*, Vol. xxxix, p. 33) and also in Laggar Falcons in the Bahāwalpūr Survey (*ibid*, Vol. xlii, p. 737).

Chloropsis jerdoni (Blyth) Jerdon's Chloropsis.

Specimens collected: 157 ♀ 24-11-39 Bandipūr (3,300'); 465 ♂ 27-12-39 Dodballapūr (2,900'); 499 ♂, 500 ♀ 29-12-39 Thōndēbhāvi (2,500'). *Biligirirangan Hills*: M4(G) ♂ 14-9-34, M7(G) ♀ M11(G) [♀] 15-9-34 (2,000' Satyamangala).

Elsewhere noted : Bedagūli (Biligirirangans), Devarbetta Hill, Nāmadachilumē, Saklēshpūr.

[Measurements :

	Bill	Wing	Tail
3 ♂♂	23-24	93-96	74.5-77 mm.
3 ♀♀	22.5-23.5	86-88	68-69.5 mm.
1 ♂ juv.	—	90	67.5 mm.

The juvenile male has no yellow wash on the forehead and no sign of a green gular patch or the yellow nimbus to it, but the moustachial patch of the adult male is partly present and there is a hint of the green shoulder patch.—H. W.]

Resident. Common in deciduous biotope and partial to secondary jungle. Both the Chloropses feed largely on flower nectar and may be met with wherever *Bombax* and *Erythrina* trees are in bloom. They are important cross-pollinating agents.

Specimen No. 499 (29 Dec.) had testes measuring 7×3 mm. No. 500 (same date) was breeding, with the largest ovum over 5 mm. I cannot, however, vouch for their being a pair.

Microscelis psaroides ganceesa (Sykes) The South Indian Black Bulbul.

Specimens collected : 609 ♀ 13-1-40 Saklēshpūr (3,000'); 698 ♀ 21-1-40 Bābābūdān Hills (4,500'—Kemmanḡūndi). *Biligirirangan Hills* : 25 ♂ 9-11-39 (4,000'—Edbūthi); [♀] 18-12-32, M₄(H) ♂, M₆(H) ♀ 27-2-34, M₅(H) ♂ 7-5-34, M₁₅(H) ♂ 8-5-34, M₃₁(H) ♀, M₃₅(H) ♂ juv. 10-5-34 (5,000'—Honnametti); M₄₅(G) ♂ 28-10-34 (4,000'—Attikān).

Elsewhere noted : Jōg, Āḡumbē.

[Measurements :

	Bill	Wing	Tail
4 ♂♂	26-27.5	118.5-120	101-103.5 mm.
5 ♀♀	24-26.5	108.5-118.5	92-102.5 mm.—H. W.]

Resident. Common and abundant in evergreen biotope, especially in *sholas* above 3,500'. Noisy flocks. Feeds largely on flower nectar and is an important cross-pollinating agent. Regularly observed probing into *Erythrina lithosperma* and *Grevillea robusta* flowers of coffee shade trees. Also into *Loranthus* blossoms. Specimens shot off the former two had pollen adhering on throat and forehead feathers.

Molpastes cafer cafer (Linn.) The Ceylon Red-vented Bulbul.

Specimens collected : 89 ♂, 90 ♀ 17-11-39 Bandipūr (3,300'). *Biligirirangan Hills* : 55 ♂ 11-11-39 (4,000'—Dodsampagi); M₃(G) ♀ 7-7-34, M₁₉(G) ♂ 10-7-34 (3,000'—Ūdahatti, E. base).

Elsewhere noted : Chāmūndi Hill (Mysore City environs), Hūnsūr, Shimsha, Devarbetta Hill, Thōndēbhāvi, Nāmadachilumē, Marikānivē, Jogimārādi, Chital-drūg, Settihalli, Kolār Gold Fields.

[Measurements :

	Bill	Wing	Tail
3 ♂♂	19-19.5	94-99	78.5-83 mm.
2 ♀♀	18	87-90	79.5 mm.—H. W.]

Resident. The Red-vented Bulbul is primarily restricted to deciduous biotope. In the Biligirirangans it is common about Pūnjūr (ca. 2,500'—deciduous country at base) but steadily decreases higher up as the biotope gradually alters its character, till between 4,500' and 5,500' elevation, where evergreen *sholas* predominate, it disappears completely. At Settihalli, in the intermediate zone, where evergreen and deciduous patches occur in juxtaposition, this species is confined to the latter while the former is occupied by the Red-whiskered Bulbul. The two species are frequently met with in association in the dry-inter belt as at Bandipūr. At Kemmanḡūndi (4,500'—Bābābūdān) it is also replaced by *Otocompsa*.

Otocompsa jocosca fuscicaudata Gould. The Southern Red-whiskered Bulbul.

Specimens collected: 143 ♀ juv. 22-11-39 Bandipūr (3,300'); 408 ♂ 21-12-39 Mākliḍrūg (2,800'). *Biligirirangan Hills*: M36(H) o? 4-4-34 (4,000'—Chiksam-pagi); M56(H) o? 19-4-34 (4,000'—Attikān); M57(H) ♂ 14-5-34, M44(G) ♀ 28-10-34 (5,000'—Honnametti); M72-74(H) ♂ ♂ ♀ 16-5-34 (4,000'—Bellāji); M23 (G) ♀ 26-5-34 (3,000'—Udahatti, E. base).

Elsewhere noted: Antarsāntē, Devarbetta, Nāmadaḥilumē, Saklēshpūr, Bābābūdan Hills, Settihalli, Agūmbē).

Also 4 specimens from Bangalore (H. G. Walton) 15-20 Jan. 1899 in B.N.H.S. collection.

[Measurements:

	Bill	Wing	Tail
11 ♂ ♂	17.5-20.5	81-88.5	78-87 mm.
2 ♀ ♀	18.5-19	84-85.5	80-81.5 mm.
2 ♀ ♀ juv.	—	75-78.5	75-79 mm.—H. W.]

Resident. A common species chiefly restricted to evergreen biotope and more or less completely replacing *Molpastes cafer* there.

Iole icterica (Strickland) The Yellow-browed Bulbul.

Specimens collected: 671 ♂, 676 ♀ 19-1-40 Bābābūdan Hills (4,500'—Kemmanḡūndi); 806 ♂ 2-2-40 Settihalli (2,500'). *Biligirirangan Hills*: 3 ♂ 6-11-39 (4,000'); [♀] 17-12-32, M27(H) ♂ 28-3-34, M41(H) ♂ 6-4-34, M18(H) ♂ 9-5-34, M29(H) ♂ 10-5-34, M77(H) ♀ 17-5-34, M108(H) ♂ 23-5-34 (4,000'-5,000'—Attikān and Honnametti); M19(G) ♂ 17-10-34 (4,000'—Edbūthi).

Elsewhere noted: Saklēshpūr, Jōg.

[Measurements:

	Bill	Wing	Tail
5 ♂ ♂	20-21	90-97	76-87.5 mm.
1 ♀	20.5	91	83 mm.—H. W.]

Resident. Common. More or less restricted to evergreen biotope. Moves about in parties in the forest canopy as well as lower down, with melodious calls.

The Biligirirangan specimen of 23 May (1934) ♂ is marked on the label as 'feeding young'.

Pycnonotus xantholæmus (Gould) The Yellow-throated Bulbul.

Specimens collected: 496 ♂, 497 ♀, 498 ♂ 29-12-39 Thōndēbhāvi (2,500'); 573 ♀ 9-1-40 Jogimaradi (3,400').

Elsewhere not noted.

[Measurements:

	Bill	Wing	Tail
2 ♂ ♂	18	89-92	85.5 mm.
2 ♀ ♀	17-17.5	87	85-86 mm.

In the Eastern Ghats Survey (*J.B.N.H.S.*, xxxv, 758) I summarised the records of this bulbul which is apparently much overlooked because of its skulking habits and the fact that the region it inhabits has not received much attention from ornithologists. Since that summary a specimen was collected at Ramandrug on 6 May 1919 (?) by Mr. E. H. Pooler and is now in the Royal Ontario Museum of Zoology. These specimens provide further welcome evidence of its distribution.—H. W.]

This bulbul is uncommon and patchily distributed in the deciduous biotope. It inhabits thin scrub jungle—less wooded facies than that of the White-browed Bulbul (*P. luteolus*.) Sparse thorn scrub, interspersed with some large trees among broken stony hillocks, formed its typical habitat. Its percussive notes when taking to wing are unmistakably like those of *P. luteolus*, but higher pitched and somewhat softer. Some of its other calls resemble those of the Red-vented Bulbul, with which species it was commonly found in association. The birds kept in pairs and were excessively shy. Their stomachs contained drupes of *Devadāru* (*Phyllanthus reticulatus*?) and Sandal (*Santalum album*)—trees on which they were largely observed feeding.

Like the other bulbuls it is instrumental in the dispersal of sandal seeds. The gonads of the 29 December specimens showed a slight development: testes 4×3 and 5×3 mm.; ovary conspicuously granular.

Pycnonotus luteolus luteolus (Lesson) The White-browed Bulbul.

Specimens collected: 122 ♀ 20-11-39 Bandipūr (3,300'); 161 ♂ 24-11-39 Maddūr (2,500'); 339 ♀ 15-12-39 Sātūr (2,500'); 418 ♂ 22-12-39 Mākliḍrūg (2,800'); 549 ♂ 7-1-40 Marikanivē (2,500'). Biligirirangan Hills: M76(G) ♂ 23-7-34 (3,000'—Udahatti, E. base).

Elsewhere noted: Hūnsūr, Shimsha, Nāmādachilumē.

[Measurements:

	Bill	Wing	Tail
4 ♂ ♂	18.5-20.5	87-91.5	78.5-86 mm.
2 ♀ ♀	19-20.5	86-90.5	78-81.5 mm.—H. W.]

Resident. To me this bulbul and *Iole icterica* have long seemed to be ecological representatives of each other in dry bush-and-scrub jungle on the one hand and evergreen forest on the other. In my field diary I have further remarked upon the fact that in the only two localities where *P. xantholaemus* was met, this species was absent. This pointedly suggests that in the same way *P. xantholaemus* may replace *P. luteolus* in the sparser bush-and-scrub country that is the characteristic habitat of the former species.

Only in No. 418 (22 Dec.) was there a slight departure in the gonads from the normal quiescent condition. They measured 4×3 mm.

From the body cavity (ruptured intestine?) of a specimen a cestode worm (*Biuterina* sp.) was removed.

Pycnonotus gularis (Gould) The Ruby-throated Bulbul.

Specimens collected: 604 ♂, 605 ♂ 13-1-40, 644 ♂ 16-1-40 Saklēshpūr (3,000'); 826 ♂ 4-2-40, 840 ♀ 5-2-40 Āgūmbē (2,500').

Elsewhere noted: Settihālli.

[Measurements:

	Bill	Wing	Tail
4 ♂ ♂	15-16	76-79	69-74 mm.
1 ♀	15	73	69 mm.—H. W.]

Resident. What I have said about the habitat of this bulbul in Travancore (*J.B.N.H.S.*, xxxviii, 90) applies equally to Mysore. It is partial to scrub-and-bush jungle in the moist-inter belt, and to abandoned coffee plantations especially where overgrown with *Lantana* thickets.

The last two specimens (4 and 5 February) were definitely breeding. The testes of No. 826 measured 6×4 mm. 840 contained a soft ovarian egg 11 mm. in diam. and her distended oviduct indicated that she had laid.

Mr. F. N. Betts informed me that he had taken a nest and eggs near Somwārpēt in Coorg (a few miles W of Saklēshpūr) in the first week of January (1940).

Microtarsus poioicephalus (Jerdon) The Grey-headed Bulbul.

Specimens collected: 124 ♀, 125 ♂ 20-11-39 Bandipūr (3,300'); 183 ♂ 28-11-39, 202 ♂ 30-11-39 Antarsāntē (2,500'); 631 ♂ 14-1-40, 645 ♂ 16-1-40 Saklēshpūr (3,000'); 758 ♂ 28-1-40 Settihālli (2,500').

Elsewhere noted: Jāgar Valley (Bābābūdan Hills).

[Measurements:

	Bill	Wing	Tail
6 ♂ ♂	15-15.5	77.5-79.5	74.5-79.5 mm.
1 ♀	14	75	70.5 mm.

Nos. 125 and 631 differ from the others in having the crown and nape, the earcoverts and the throat the same olive-green as the rest of the upper parts instead of bluish-slate as in most specimens. The upper surface of the tail also has the grey largely replaced by green. This variation is not given in the usual descriptions and I cannot see that it is a mark of either age or sex. There are similar specimens in the British Museum. It seems to me to be

merely a mutation similar to that found in *Microtarsus atriceps* (vide Ticehurst, *Ibis* 1939, p. 563). Incidentally I may point out that the juvenile of this species is unknown and the moults are undescribed.—H. W.]

Resident. While being confined to the humid evergreen biotope of S-W India, the characteristic habitat of this bulbul appears to be the moist-inter zone. It is thus found only in the western portions of the State where, however it is not uncommon. The birds are usually met with in small parties of 3 or 4. They have a clear, rather tinny whistling call *weet...weet* and so on, not unlike that produced by a man to induce his tame partridge to call. The whistles are punctuated now and again by a harsh *chake*.

I observed the birds feeding largely on the berries of the plant known in Canarese as *Kadāvē* (*Stephegyne parvifolia*?) and also on the fruits of *Dendiga* or *Bejalo*. The stomach contents of several of the specimens comprised entirely of these.

Nothing as regards breeding was suggested by the gonads of the specimens.

Brachypteryx major major (Jerdon) The Rufous-bellied Shortwing.

Specimens collected: 711 ♂ 22-1-40, 729 ♀, 730 ♀ 24-1-40 Bābābūdan Hills (4,500'—Kemmanḡūndi).

Elsewhere not noted.

[Measurements:

	Bill	Wing	Tail
1 ♂	18	81	63.5 mm.
2 ♀ ♀	17-18	76.5-77.5	59 mm.

No. 729 is evidently in first winter plumage as two or three fulvous spotted feathers of the juvenile plumage can still be detected at the sides of the nape and on the throat, and with this clue it is possible to detect faint traces of a fulvous apical spot on a median wing covert. There is a slight olive-brown wash on the lower back, rump and breast which may also be a sign of immaturity. The plumages and moults of this species are of course not known and it seems a pity that observers in the hills of S-W India cannot remedy the deficiency.

As this race has hitherto only been recorded from the Nilgiris and Brahmagiris the specimens indicate a considerable extension of range.—H. W.]

Resident. A bird of evergreen biotope, frequenting *sholas*. Seen singly hopping in and out of the undergrowth and on to the edge of paths. Silent, shy and retiring. Frequent, but not common in its accustomed facies.

Tarsiger brunnea brunnea (Hodgs.) The Indian Blue Chat.

Specimens collected: 714 ♂, 715 ♂ 23-1-40 Bābābūdan Hills (4,500'—Kemmanḡūndi); 802 ♂ 1-2-40 Settihālli (2,500'); 836 ♀ 5-2-40 Āgūmbē (2,500'); 867 ♀ 12-2-40 Jōg (2,000'). *Biligirirangan Hills*: ♂ 18-12-32, ♂ 24-12-32 (5,000'—Honnametti).

Elsewhere noted: Saklēshpūr.

[Measurements:

	Bill	Wing	Tail
5 ♂ ♂	15-16	75.5-78.5	45-49.5 mm.
2 ♀ ♀	15	73.5-74.5	46 mm.—H. W.]

A fairly common winter visitor; restricted to evergreen biotope. Dank cardamom ravines, *Calamus* and *Pandanus* brakes constitute its favourite habitat. Here it is usually seen singly flitting amongst the undergrowth, alighting on the ground and hopping about in search of insect food. The tail is jerked up and expanded from time to time.

Saxicola caprata caprata (Linn.) The South Indian Pied Bush-Chat.

Specimens collected: 74 ♂ 15-11-39 Bandipūr (3,300'); 308 ♀ 9-12-39 Hūnsūr (2,000'); 457 ♀, 462 ♀ Dodballapūr (2,000'); 709 ♂ 22-1-40, 716 ♀ 23-1-40 Bābābūdan Hills (4,500'—Kemmanḡūndi); *Biligirirangan Hills*: ♂ 31-12-32 (5,000'—Dodsampagi); M29(H) ♀ 23-4-34, M81(H) ♀ 18-5-34, M121-122

(H) ♂ ♀ 26-5-34, M6(G) ♂ 10-10-34, M7(G) ♀ 11-10-34 (4,000'—Bellāji); M45(H) ♂ 8-4-34, M52(H) ♂ 25-4-34 (5,000'—Honnametti); M65-66(H) ♂ ♀ 15-5-34 (4,000'—Shenemenhalla); M96(H) ♀ 19-5-34 (4,000'—Magoolibetta).

Elsewhere noted: Begūr, Kolār Gold Fields.

[Measurements:]

	Bill	Wing	Tail
8 ♂ ♂	14-16	72-77	50-62 mm.
9 ♀ ♀	13.5-16.5	68.5-72.5	47.5-51 mm.

No. 457 ♀ could not be separated from a female of the Northern race *S. c. bicolor* and it may well be a migrant of that form. This series shows—as one might expect—some intergrading to the large-billed form of the Nilgiris, Palnis and Travancore ranges (*nilgiriensis*) which I have recently (*Bull. B.O.C.*, Vol. ix, p. 90 (1940), separated from the true *S. c. caprata* of Ceylon in consequence of a fresh study of this group in connection with material obtained by the Ceylon Survey.—H. W.]

Resident. The Pied Bush-Chat is fairly common, but not abundant. Isolated pairs are met with in grass-covered areas, frequently at the edge of *sholas*. The restricted amount of white on the abdomen of this race is conspicuous in the field.

Saxicola torquata indica (Blyth) The Collared Bush-Chat.

Specimens collected: 73 ♀ 15-11-39 Bandipūr (3,300'); 361 [♂] 16-12-39 Sātūr (2,500'); 494 ♀ 28-12-39 Doddballapūr (2,900'); 717 ♀ 23-1-40 Bābābūdan Hills (4,500'—Kemangūdi).

Elsewhere noted: Māndya.

[Measurements:]

	Bill	Wing	Tail
1 ♂	13.5	68	47 mm.
3 ♀ ♀	14	66-68.5	46-47.5 mm.—H. W.]

An uncommon winter visitor. Sporadic solos usually met with on fallow land about cultivation, or amongst bulrushes and reeds on marshy ground. Occasionally also on grassy hills in the same facies as the Pied Bush-Chat.

Phoenicurus ochruros rufiventris (Vieillot.) The Eastern Indian Redstart.

Specimens collected: 216 [♀] 1-12-39 Antarsāntē (2,500'); 322 ♂, 323 ♂ 13-12-39 Sātūr (2,500'); 429 ♂ 24-12-39, 452 ♀ 26-12-39 Doddballapūr (2,900'); 503 ♀ 29-12-39 Thōndēbhāvi (2,500').

Elsewhere noted: Hangala (near Gūndlūpet).

[Measurements:]

	Bill	Wing	Tail
3 ♂ ♂	14.5-15.5	86-88	60-63 mm.
3 ♀ ♀	14.5-15	84-86	60-60.5 mm.—H. W.]

Winter visitor. Not uncommon in the Maidān, affecting dry, stony sparsely scrubbed areas. Met with singly. I never found it in evergreen biotope.

Cyanosylvia svecica subsp.? The Bluethroat.

No specimens.

Noted: Māndya, Kolār Gold Fields.

Winter visitor: decidedly uncommon. Single birds were observed amongst irrigated standing sugar-cane and paddy crops in the former locality, and reeds bordering Bētmangala tank in the latter.

Saxicoloides fulicata ptymatura (Vieill.) The South Indian Robin.

Specimens collected: 218 ♂ 1-12-39 Antarsāntē (2,500'); 299 ♂ 8-12-39 Seringapatām (2,000'); 443 ♂ 24-12-39, 489 ♀ 28-12-39 Doddballapūr (2,900'); 564 ♀ 8-1-40 Marikānivē (2,500'). Biligirirangan Hills: M25(G) o? 12-7-34 (3,000'—Udahatti, E. base).

Elsewhere noted: Bandipūr, Herikerē (near Gūndlūpet), Maddūr, Begūr, Shimsha, Sivāsāmūdrām, Sātūr, Nāmadachilumē, Bhadrāvati, Kolār Gold Fields.

[Measurements :

	Bill	Wing	Tail
4 ♂ ♂	15-16	74-80	62.5-66.5 mm.
2 ♀ ♀	15-16	73-74	62-66 mm.

For my reasons for using the name *ptymatura* of Vieillot consequent on the separation of S. Indian birds from those of Ceylon see Travancore Survey Report (J.B.N.H.S., xxxviii, 285)—H. W.]

A resident of deciduous biotope. Common. Preferential habitat: dry, thin jungle with ant-hills, and scrub-and-bush country.

One or two examples were observed hopping about and feeding amongst the gloomy-looking dumps of scrap iron—derelict hurricane lanterns, twisted and distorted motor car wheels and chassis etc.—in the yard of the Mysore Iron Works at Bhadrāvati!

By the middle of December males were busy chasing females and strutting and displaying before them. Major Phythian-Adams took a c/3. near Maddū. (Gündlüpet) on 14 April (1927).

Copsychus saularis ceylonensis Sclater. The Ceylon Magpie Robin.

Specimens collected: 236 ♀ 2-12-39 Manchgowdanhalli (2,500'); 440 ♂ 24-12-39 491 ♀ 28-12-39 Dodballapūr (2,900'). *Biligirirangan Hills*: M20(G) ♂ 19-9-34 (2,000'—Satyamangala); M18(G) ♀ 10-7-34, M59(G) ♂ 19-7-34 (3,000'—Udahatti, E. base).

Elsewhere noted: Bandipūr, Shimsha, Sivāsamūdrām, Nāmadachilumē, Saklēshpūr, Jāgar Valley (Bābābūdans).

[Measurements :

	Bill	Wing	Tail
3 ♂ ♂	20-22	103-105	89-91.5 mm.
3 ♀ ♀	20-21.5	94-98	81.5-84 mm.

These birds are, as one would expect, slightly intermediate with *saularis saularis*, but there is no doubt that they are much closer to *ceylonensis*, and should be kept with it.—H. W.]

Resident. Fairly common. Inhabits deciduous biotope—light jungle, orchards and wooded compounds. In the Jāgar Valley it was once met with in the bamboo facies of the intermediate zone—in the typical habitat of the Shāma (*Kittacincla*).

Mostly silent between November and mid-January; thereafter song increasingly heard.

Kittacincla malabarica ssp. The Shāma.

Specimens collected: 188 ♀ 28-11-39 Antarsāntē (2,500'); 237 ♀ 2-12-39, 280 ♂ 6-12-39 Manchgowdanhalli (2,500'); 796 ♀ 31-1-40, 797 ♀ 1-2-40 Settihālli (2,500').

Elsewhere not noted.

[Measurements :

	Bill	Wing	Tail
1 ♂	19.5	97	184 mm.
4 ♀ ♀	18-20	87-92	113.5-136.5 mm.

There is a noticeable difference between the two females No. 796 and 797 from Settihalli and the other two Nos. 188 and 237 from Antarsāntē and these last agree with No. 880 in the Travancore Survey (as described in *Journal B.N.H.S.*, xxxviii, 288). These last are much more richly coloured birds, blacker above and on the throat and breast and rather deeper chestnut below i.e. they approach the male plumage in type, thereby affording a connecting link with the Ceylon race (which I have described elsewhere) in which the male and female are virtually indistinguishable. These dark birds are of course the true *malabarica* of which the type locality is Mahé on the Malabar Coast (vide *J.B.N.H.S.*, xxxvi, 74).

It would seem, therefore, that here again we have a distinction between a richly coloured Malabar Coast race and a paler form in the centre and east of the Peninsula. Unfortunately I have not yet been able to verify the point

fully. Of the 3 females collected by the Eastern Ghâts Survey one was albinistic. Under war conditions I am unable to re-examine the other two, but my memory is that they were pale birds. The only females from the Peninsula in the British Museum are 3 of Davidson's birds from North Kanara. These are, as one might expect, intermediate between the two types. If fresh material comes to hand and verifies the point it will be necessary to name the form with the pale females.—H. W.]

Resident. Common. Restricted to deciduous biotope, and within this partial to bamboo facies. It also enters the intermediate zone to a lesser extent. Song (only occasionally heard during the Survey period) rather like that of *Muscicapula tickelliae* but louder, richer and more thrushlike in quality.

Turdus simillimus mahrattensis Whistler. The Black-capped Blackbird.

Specimens collected: 526 ♀ 2-1-40 Nāmadachilumē (3,000'); 606 ♂ 13-1-40, 624 ♀, 625 ♂ 14-1-40 Saklēshpūr (3,000'); 674 ♀ 19-1-40 Bābābūdan Hills (4,500'—Kemmangūndi).

Elsewhere noted: Bandipūr, Biligirirangan Hills (ca.—5,000').

[Measurements:

	Bill	Wing	Tail
2 ♂♂	26.5-28.5	132-135.5	97-98 mm.
3 ♀♀	25-26	120.5-123.5	84-92 mm.

In spite of the fact that the 2 males have a wing formula of $2=7/8$ and the 3 females of $2=6/7$ I think they all undoubtedly belong to the same form, and this after careful comparison at the British Museum I think must be taken as *mahrattensis* though there is apparently, as one might expect, some intergrading into *simillimus*.—H. W.]

Not common and rather sporadic in its local distribution which includes wooded country in both the evergreen and deciduous biotopes. It evidently moves about a good deal locally with the ripening of the various fruits and berries on which it feeds. During November, for example, it was completely absent in the neighbourhood of Bandipūr. This locality was re-visited on 25/26 February when the Banyan and other figs had ripened, and the Blackbird (race?) was then common and plentiful.

Lantana berries and sandalwood drupes are also extensively eaten and their seeds dispersed. The Black-capped Blackbird is likewise very partial to the nectar of *Erythrina* and *Bombax* flowers.

Before about the 3rd. week of February the birds were mostly silent, only uttering the familiar, throaty, quick-repeated *chuck-chuck-chuck* as they flew about; but thereafter the rich song (or bars of it) were occasionally heard.

The birds were excessively shy at all times.

Turdus simillimus simillimus (Jerdon) The Nilgiri Blackbird.

Specimens collected: *Biligirirangan Hills*: ♀♀ 18-12-32 (5,000'—Honnametti).

[Measurements:

	Bill	Wing	Tail
2 ♀♀	24	121-123.5	94-99 mm.—H. W.]

As no specimens were collected at Bandipūr in February, I am unable to say whether the birds there belonged to this race or were *mahrattensis*.

Bandipūr lies at the foot of the Gūdalūr Ghāt over which runs the Mysore-Nilgiri motor road.

Geokichla wardii (Blyth). The Pied Ground Thrush.

Specimens collected: *Biligirirangan Hills*: M39(H) ♂ 5-4-34, M44(H) ♀ 7-4-34 (4,000'—Bellāji).

[Measurements:

	Bill	Wing	Tail
1 ♂			
1 ♀	25	119.5	—
	27	118	27.5—H. W.]

These specimens were doubtless on spring passage from their winter quarters in Ceylon to their Himalayan breeding grounds. The species was not met with by the Survey between November and March.

Geokichla citrina cyanotus (Jardine & Selby). The White-throated Ground Thrush.

Specimens collected: 620 ♂, 621 ♂ 14-1-40 Saklëshpūr (3,000'); 755 ♂ 28-1-40 Settihālli (2,500'). *Biligirirangan Hills*: M₃(H) ♀ 3-3-34, M₅₂(H) ♀ 10-4-34, M₁₉(H) ♂ 9-5-34, M₃₄(H) ♂ 10-5-34 (5,000'—Honnametti); M₃₈(H) ♀ 6-4-34 4,000'—Bellāji); M₃₉(G) ♀ 26-10-34 (4,000'—Attikān).

[Measurements:

	Bill	Wing	Tail
7 ♂ ♂	22-24	109-112	73-76 mm.
2 ♀ ♀	21.5-23.5	106.5-111	72.5-75 mm.—H. W.]

Dank cardamom *sholas* and coffee plantations never fail to harbour this species. It spends its time hopping about on the ground, rummaging the mulch for insects. Betts informs me that it breeds abundantly in Coorg during the S-W Monsoon, building its open stick nest on the coffee plants.

Oreocincla dauma nilgiriensis Blyth. The Nilgiri Thrush.

Specimen collected: *Biligirirangan Hills*: M₄₃(H) ♂ 12-5-34 (5,000'—Honnametti).

An inhabitant of evergreen biotope, partial to *sholas*. The Survey did not come across this species.

Monticola cinclorhyncha (Vigors). The Blue-headed Rock-Thrush.

Specimens collected: 668 ♀, 669 ♀, 670 ♀ 19-1-40, 718 ♂, 728 ♀ 23-1-40, 733 ♂ 24-1-40 Bābābūdan Hills (4,000-4,500'—Kemmanḡūndi); 814 ♂ 2-2-40 Settihālli (2,500'); 825 ♂, 827 ♀ 4-2-40 Āgūmbē (2,500'). *Biligirirangan Hills*: 16 ♂ 8-11-39 (3,000'—Bedagūli); 60 ♂ 11-11-39, M₂₁(H) ♂ 25-3-34, M₁₂(G) ♂, M₁₄(G) ♀ 15-10-34, M₂₃(G) ♂ 21-10-34, M₃₆(G) ♀ 22-10-34, M₄₃(G) [♀] 27-10-34 (5,000'-5,500'—Honnametti); M₂₅(G) [♂], 18-10-34 (4,000'—Attikān); [♂] 18-12-32, ♂ ♀ 21-12-32, ♂ 30-12-32 (4,000'—Dodsampagi).

Elsewhere noted: Saklëshpūr, Jōg.

[Measurements:

	Bill	Wing	Tail
13 ♂ ♂	22-25	99-108.5	65-71 mm.
9 ♀ ♀	22.5-25	97.5-103	66-71 mm.—H. W.]

A common and abundant winter visitor. Earliest date 15 October; latest 25 March. Met with singly in coffee and cardamom plantations and secondary evergreen jungle. Occasionally also observed in deciduous thorn scrub-and-grass patches on the edge of evergreen.

Monticola solitaria pandoo (Sykes) The Indian Blue Rock-Thrush.

Specimens collected: 331 ♂ 13-12-39 Sivāsamūdrām (2,500'); 376 ♂ 19-12-39 Nandidrūg (4,000'); 412 ♀ 22-12-39 Mākli-drūg (2,800'); 541 ♀ 4-1-40 Nāmada-chilumē (3,000'); 684 ♂ 20-1-40 Bābābūdan Hills (5,000'—Kemmanḡūndi); *Biligirirangan Hills*: 59 ♂ 11-11-39 (5,500'—Honnametti).

Elsewhere noted: Jōg.

[Measurements:

	Bill	Wing	Tail
4 ♂ ♂	26.5-29	118.5-123	80.5-82.5 mm.
2 ♀ ♀	25.5-27	113-114	75-77 mm.—H. W.]

Winter visitor. Not uncommon. Solitary birds observed haunting quarries and rock scarps. Also seen about the iron mines at Kemmanḡūndi, on rocks in the 'cauldron' at the bottom of Jōg (Gersoppa) Falls, and on the magnificent old temples at Halēbid and Belūr.

From the body cavity of No. 376 was removed a nematode—*Diplotriaeana* sp. (Fam. Filariidae).

Myophonus horsfieldii Vigors. The Malabar Whistling Thrush.

Specimens collected: 667 ♂ 17-1-40 Saklëshpūr (3,000'); 860 ♀ 11-2-40 Jōg (2,000') Biligirirangan Hills: 8 ♂ 6-11-39 (4,000'); ♂ 18-12-32 (5,000'); M12(H) ♂ 10-3-34 (4,000'); M23(H) ♂ 26-3-34 (4,000'—Chiksampagi); M59-60(H) ♂ ♀ 14-5-34 (5,000').

Elsewhere noted: Bābābūdan Hills (Jāgar Valley 2,500'; Kemmangūndi 4,500'), Settihālli.

[Measurements :

	Bill	Wing	Tail
7 ♂ ♂	32-34.5	152-165	112-121 mm.
2 ♀ ♀	31.5	145-149.5	94-108 mm.

I am now of opinion that this form should be admitted to the rank of a species.—H. W.]

Common on all rocky, and preferably torrential, hill streams in evergreen biotope and also in the moist-inter belt. One was observed in the 'cauldron' at the bottom of the falls at Jōg.

Muscicapa parva parva Bechst. The European Red-breasted Flycatcher.

Specimens collected: 116 ♂ 19-11-39 Bāndipūr (3,300'); 353 ♀ 15-12-39 Devarbetta Hill (3,000'); 622 ♀ 14-1-40 Saklëshpūr (3,000').

Elsewhere noted: Bābābūdan Hills (Jāgar Valley 2,500'; Kemmangūndi 4,500').

[Measurements :

	Bill	Wing	Tail
1 ♂	14	72	51 mm.
2 ♀ ♀	12.5-13.5	64-66	48-50 mm.—H. W.]

Winter visitor. Not common. Seen singly or in pairs in wooded compounds and light deciduous forest with a sprinkling of large Banyan and other well foliated trees.

On 23 January a specimen in perfect red-breasted plumage was observed near the Staff Quarters at Kemmangūndi.

Muscicapula superciliaris superciliaris (Jerdon). The White-browed Blue Flycatcher.

Specimen collected: 523 ♂ 2-1-40 Nāmadachilumē (3,000').

[Measurements :

	Bill	Wing	Tail
1 ♂	12	63.5	45.5 mm.

This is a great extension of range. The species has not been previously recorded south of Ahmadnagar (Fairbank, *Stray Feathers*, iv, 257) and Narsampēt in Hyderābād State (Sālim Ali, *J.B.N.H.S.*, xxxvi, 387)—H. W.]

Winter visitor. This was the only example met with by the Survey—in light deciduous forest with large Banyans and tamarinds scattered about.

Muscicapula pallipes pallipes (Jerdon) The White-bellied Blue Flycatcher.

Specimens collected: 721 ♂ 23-1-40 Bābābūdan Hills (4,000'—Kemmangūndi); 739 ♂ 26-1-40, 766 ♂ 29-1-40, 789 ♀ 31-1-40 Settihālli (2,500'); 821 ♂ 4-2-40, 848 ♀ 8-2-40 Āgūmbē (2,000'-2,500').

Elsewhere not noted.

[Measurements :

	Bill	Wing	Tail
4 ♂ ♂	16-17.5	75.5-81	59.5-63 mm.
2 ♀ ♀	17	72-72.5	54-55.5 mm.—H. W.]

A fairly common resident of evergreen biotope. Usually met with singly in *sholas* &c, in undergrowth of straight thin seedlings or cardamom plants.

Muscicapula rubeculoides rubeculoides (Vigors). The Blue-throated Flycatcher.

Specimens collected: 209 ♂ 30-11-39, 245 ♂ 3-12-39 Manchgowdanhalli (Antarsāntē, 2,500'); 663 ♂ 17-1-40 Saklēshpūr (3,000'); 765 ♀ 29-1-40, 782 ♂ 30-1-40 Settihālli (2,500').

Elsewhere noted: Bābābūdan Hills (Jāgar Valley 2,500').

[Measurements:

	Bill	Wing	Tail
3 ♂ ♂	14.5	70-77	50-60 mm.
2 ♀ ♀	14-15	72.5-73.5	54 mm.—H. W.]

Resident. Bamboo facies of the moist-inter zone is the typical habitat of this flycatcher. Occasionally it is also found in the same patch of jungle as Tickell's Blue Flycatcher, although on the whole the latter prefers drier facies.

Muscicapula tickelliae tickelliae (Blyth). Tickell's Blue Flycatcher.

Specimens collected: 98 ♂ 18-11-39 Bandipūr (3,300'); 164 [♀] 24-11-39 Maddūr (2,500'); 279 ♂ 5-12-39 Antarsāntē (2,500'); 330 ♂ 13-12-39 Shimsha (2,500'). *Biligirirangan Hills*: M22(G) ♂ 20-9-34 (2,000'—Satyamangala); M23(G) ♂ 12-7-34, M90(G) ♂ 25-7-34 (3,000'—Udahatti, E. base).

Elsewhere noted: Bedagūli, Hūnsūr, Sivāsamūdrām, Nāmādachilumē.

[Measurements:

	Bill	Wing	Tail
6 ♂ ♂	14-15.5	70-77	56.5-63.5 mm.
1 ♀	14	72	57 mm.—H. W.]

Resident and common. Typical habitat: Thin deciduous jungle intermixed with bamboo clumps.

It is also found in dry secondary scrub-and-bush country, often as a member of the mixed hunting parties of insectivorous birds. At Hūnsūr it was observed in ancient trees in the old garrison compounds.

Eumiyas albicaudata (Jerdon) The Nilgiri Verditer Flycatcher.

Specimens collected: 701 ♀ 21-1-40, 726 ♂ 23-1-40 Bābābūdan Hills (4,500'—Kemmanūndi). *Biligirirangan Hills*: 4 ♂ 6-11-39 (4,000'); 0? 18-12-32, ♂ 22-12-32 M63(H) ♀ 25-4-34, M33(H) ♀ 10-5-34, M39(H) [♂] 11-5-34, M44-45 (H) ♂ 12-5-34, M52(H) juv., M54-55(H) ♀ ♂ 14-5-34, M18(G) ♂ 16-10-34 (5,000'—Honnametti); M35(H) ♀, M38(H) ♂ 4-4-34 (4,000'—Chiksampagi); M79(H) ♂ juv. 17-5-34, M104-105(H) ♀ ♂ 23-5-34 (4,000'—Bellāji); M111(H) ♂ 24-5-34 (4,000'—Edbūthi); M47(G) ♀ 29-10-34 (4,000'—Attikān).

[Measurements:

	Bill	Wing	Tail
12 ♂ ♂	14-15	76-82	61-67.5 mm.
7 ♀ ♀	14-15	74.5-78.5	59-61 mm.

The Bābābūdan Hills specimens provide a slight extension of range as this flycatcher was not previously recorded from north of the Nilgiris.—H. W.]

Resident. Typical habitat: Evergreen biotope. *Sholas* above ca. 3,000' elevation.

Gonads of the January specimens were maturing (testes 4×3 mm., ovary granular) and the birds were in song. No. 701, a female, was also singing!

Two of the Biligiri specimens collected in May were juveniles. The nesting season is evidently between February and May. In the Nilgiris it is said to breed principally between March and May.

Eumiyas thalassina thalassina (Swainson) The Veriter Flycatcher.

Specimens collected: 352 ♂ 15-12-39 Devarbetta Hill (3,000'); 518 ♂ 1-1-40 Nāmādachilumē (3,000'); 801 [♀] 1-2-40 Settihālli (2,500').

Elsewhere noted: Bandipūr, Saklēshpūr.

[Measurements:

	Bill	Wing	Tail
2 ♂ ♂	13	87-89	69-74 mm.
1 ♀	12.5	80	62.5 mm.—H. W.]

Winter visitor. Fairly generally distributed, but nowhere common or abundant. Affects well-wooded deciduous country and the dry-inter belt. Met with singly.

Alseonax latirostris (Raffles) The Brown Flycatcher.

Specimens collected: 265 ♂ 4-12-39 Karāpūr (2,500'); 273 ♀ 5-12-39 Antar-sāntē (2,500'); 340 ♂ 15-12-39 Sātūr (2,500'); 434 ♀ 24-12-39 Dodballapūr (2,900'); 713 ♀ 22-1-40 Bābābūdan Hills (4,500'—Kemmangūndi); 869 ♂ 12-2-40 Jōg (2,000') Biligirirangan Hills: M41(G) ♂ 17-7-34, M65(G) ♂ 20-7-34 (3,000'—Ūdahatti, E. base).

[Measurements:

	Bill	Wing	Tail
3 ♂♂	13.5-14.5	69-73	46-51.5 mm.
4 ♀♀	12.5-14.5	66-72	47-50 mm.—H. W.]

Apparently resident. Typical habitat: Deciduous biotope. Thin open forest (or teak plantations) with bamboo intermixed and undergrowth of grass and sparse scrub. Also met with sparingly in the intermediate zone and rarely up to the proximal fringe of evergreen, among shade trees in cardamom plantations.

Alseonax ruficauda (Swainson). The Rufous-tailed Flycatcher.

Specimens collected: 817 ♀ 4-2-40, 832 ♀ 5-2-40 Āgūmbē (2,500'). Elsewhere not noted.

[Measurements:

	Bill	Wing	Tail
2 ♀♀	14.5-15.5	76-77	55.5-58 mm.—H. W.]

Evidently a winter visitor. Uncommon. Met with singly in evergreen biotope, haunting the canopy of lofty trees.

Alseonax muttui muttui (Layard) Layard's Flycatcher.

Specimens collected: 608 ♂ 13-1-40 Saklēshpūr (3,000'); 833 ♂ 5-2-40, 854 ♂ 8-2-40 Āgūmbē (2,500'). Elsewhere not noted.

[Measurements:

	Bill	Wing	Tail
3 ♂♂	16-17	72-75	50.5-54 mm.—H. W.]

Winter visitor. Met with singly in evergreen biotope. Frequents cardamom sholas, keeping to low trees and looping liana tangles.

Ochromela nigrorufa (Jerdon) The Black-and-Orange Flycatcher.

Specimens collected: Biligirirangan Hills: ♂ 9-12-32, ♀ 24-12-32, M24-25(H) ♂♂ 9-5-34, M47(H) ♀ 12-5-34, M119-120(H) ♂♀ 26-5-34 (5,000'-5,500'—Honnametti); M42(H) ♀ 6-4-34 (4,000'—Bellāji); M23(G) ♂ 18-10-34 (4,000'—Attikān).

[Measurements:

	Bill	Wing	Tail
5 ♂♂	13.5-14	60.5-63	47.5-50 mm.
5 ♀♀	12.5-13.5	55-59	41-45.5 mm.—H. W.]

This flycatcher which was not uncommon at Honnametti (4-5,000'—Biligirirangans) in the second half of December 1932, was curiously enough not met with at all in that locality between 5 and 12 November 1939, neither in the first week of March 1940. It was not noted elsewhere in Mysore State either.

Typical habitat: Evergreen biotope. Sholas above ca. 3,500' elevation. Undergrowth of thin upright seedlings, ceta facies, cardamom plants and rattan brakes in dank ravines.

Culicicapa ceylonensis ceylonensis (Swainson) The Grey-headed Flycatcher.

Specimens collected: 710 ♂ 22-1-40 Bābābūdan Hills (4,500'—Kemmangūndi); Biligirirangan Hills: 23 ♂ 8-11-39 ♂ 17-12-32, M46(H) ♂ 12-5-34 (5,000'—

Honnametti); M24(G) ♂ 18-10-34 (4,000'—Attikān); M42(G) ♂ 27-10-34 (4,000'—Bellāji).

Elsewhere noted: Jāgar Valley (2,500'—Bābābūdans); Settihālli, Jōg. At Saklēshpūr and Āgūmbē it appeared unaccountably to be absent!

[Measurements :

	Bill	Wing	Tail
6 ♂♂	12-14	58.5-66.5	49-59 mm.

I have recently had the opportunity of examining a fine series of topotypes of this species in the Ceylon Survey, and after comparison it is clear that birds from the Eastern Himalayas and India generally are intermediate between the typical race and *C. c. pallidus* of the Western Himalayas. I very much doubt, however, whether it is worth providing a name for these intermediates and for the moment, at any rate, leave the Mysore series under the typical race.—H. W.]

Resident. Not uncommon in suitable facies.

This flycatcher is found in evergreen biotope and throughout the intermediate zone; occasionally and in small numbers to the fringe of the deciduous. It is partial to bamboo facies. The bird is almost invariably met with as a member of the mixed hunting parties of small insectivorous species of which *Sitta frontalis* and *Phylloscopus occipitalis* (in winter) are, some of the most regular constituents.

Tchitrea paradisī paradisī (Linn) The Paradise Flycatcher.

Specimens collected: 193 ♀ 28-11-39, 197 ♂, 198 ♂ 29-11-39 Antarsāntē (2,500'); 752 ♂, 753 ♂ 28-1-40, 771 ♂ 29-1-40 Settihālli (2,500'); 831 ♀ 5-2-40 Āgūmbē (2,500'). *Biligirirangan Hills*: ♂ 18-11-32, M11(G) ♂ 15-10-34 (5,000'—Honnametti); M17(G) ♂, M21(G) ♂ 19-9-34 (2,000' Satyamangala).

[Measurements :

	Bill	Wing	Tail	Streamers
3 ♂♂ (white streamers)	23-24	91.5-96	106-107	312-364 mm.
2 ♂♂ (red streamers)	25.5-26	92.5-95.5	103	287 mm.
2 ♂♂ (like ♀)	23-25	88-89	94.5-97	—
2 ♀♀	22.5-23.5	89.5-92.5	94-103.5	—

The identity of the 3 white ♂♂ has of course to be merely presumed.—H. W.]

Tchitrea paradisī leucogaster (Swainson).

Specimens collected: 772 ♂ 30-1-40, 810 ♂ 2-2-40 Settihālli (2,500').

[Measurements :

	Bill	Wing	Tail	Streamers
2 ♂♂	23-24.5	93.5-94.5	101-104	256-286 mm.

Both are red and white males with red streamers and parti-coloured red and white wings.—H. W.]

Elsewhere noted (subspecies?): Bandipūr, Devarbetta Hill, Nāmadachilumē, Saklēshpūr, Bābābūdān Hills (4,500'—Kemmangūndi; 3,500'—Dodabbi Falls).

Fairly common. Most partial to the intermediate zone, especially bamboo facies, but extending somewhat sparingly into both extreme biotopes. Chestnut-plumaged birds formed the majority of those seen.

Hypothymis azurea styani (Hartlaub) The Black-naped Blue Flycatcher.

Specimens collected: 99 [♀] 18-11-39, 115 ♀ 19-11-39 Bandipūr (3,300'); 205 ♂ 30-11-39 Antarsāntē (2,500'); 214 ♀ 30-11-39 Manchgowdanhālli (2,500'); 520 ♀ 1-1-40 Nāmadachilumē (3,000'); 623 ♂ 14-1-40 Saklēshpūr (3,000'); 800 ♀ 1-2-40, 808 ♂ 2-2-40 Settihālli (2,500'); 843 ♀ 7-2-40 Āgūmbē (2,500').

Elsewhere noted: Bedagūli (3,000'—Biligirirangan Hills), Devarbetta Hill.

[Measurements :

	Bill	Wing	Tail
3 ♂♂	14.5-15	71-72	68-74 mm.
5 ♀♀	15-16	68-73.5	65-70 mm.—H. W.]

Resident. More or less confined to deciduous biotope. Also met with sparingly in the intermediate zone. Partial to bamboo facies.

Leucocirca aureola compressirostris Blyth. The White-browed Fantail Flycatcher

Specimens collected: 85 ♂ 17-11-39 Bandipūr (3,300'); Biligirirangan Hills: M35(G) ♂ 14-7-34, M60(G) ♂ 21-7-34 (3,000'—Udahatti, E. base).
Elsewhere noted: Maddūr, Hūnsūr.

[Measurements:

	Bill	Wing	Tail
3 ♂ ♂	14-15	83-85.5	88-88.5—H. W.]

Resident. Confined to deciduous biotope in which it occurs practically in every facies except stony semi-desert and those bordering on it.

Lanius vittatus Valenciennes. The Bay-backed Shrike.

Specimens collected: 83 ♂ 17-11-39 Bandipūr (3,300'); Biligirirangan Hills: M11(G) ♀ 8-8-34, M99(G) ♂ 27-7-34, M105-106(G) ♂ o? 31-7-34 (3,000'—Udahatti, E. base).

Elsewhere noted: Antarsāntē, Karāpūr, Hūnsūr, Nāmadachilumē, Kolār Gold Fields.

[Measurements:

	Bill	Wing	Tail
2 ♂ ♂ ad.	16-17.5	88	92.5 mm.
1 ♀ ad.	17	86	— mm.
1 ♂ juv.	—	83	84.5 mm.—H. W.]

Resident? Not common. Restricted to deciduous biotope. The habitat typical of this species is midway between the semi-desert preferred by the Grey Shrike and the better wooded orchard-like country which the Grey-backed Shrike frequents.

Lanius schach caniceps Blyth. The Grey-backed Shrike.

Specimens collected: 76 ♂ 15-11-39 Bandipūr (3,300'); 338 [♀] 15-12-39 Sātūr (2,500'); 509 ♂ 31-12-39 Nāmadachilumē (3,000'). Biligirirangan Hills: M4-5(G) ♂ juv., ♂ juv. 7-7-34 (3,000'—Udahatti, E. base).

Elsewhere noted: Antarsāntē, Karāpūr.

[Measurements:

	Bill	Wing	Tail
2 ♂ ♂ ad.	20-21	89	110.5-111 mm.
2 ♂ ♂ juv.	—	89-90	105-105.5 mm.—H. W.]

Resident. Restricted to deciduous biotope. Its typical habitat has been indicated above. Breeds evidently in May and June.

Lanius cristatus cristatus Linn. The Brown Shrike.

Specimens collected: 82 ♂ 17-11-39, 97 ♀ 18-11-39, 146 ♂ 23-11-39 Bandipūr (3,300'); 215 ♂ 1-12-39 Antarsāntē (2,500'). Biligirirangan Hills: 62 ♀ 12-11-39 (5,500'—Honnāmetti); M51(H) ♀ 10-4-34 (4,000'—Bellāji).

Elsewhere noted: Karāpūr, Nāmadachilumē, Settihālli, Kolār Gold Fields.

[Measurements:

	Bill	Wing	Tail
3 ♂ ♂	19-20.5	85-87.5	81.5-82.5 mm.
3 ♀ ♀	19-20	88.5	78-89 mm.—H. W.]

The Brown Shrike is a very common and abundant winter visitor to Mysore. Latest date 10 April. It is found in both evergreen and deciduous biotopes, but mostly in the latter and in the intermediate zone. It occurs in almost every facies and invariably singly. Its habits are often crepuscular, and the bird may be seen on the move and hunting till after dusk.

Hemipus picatus picatus (Sykes) The Black-backed Pied Shrike.

Specimens collected: 180 ♂ 25-11-39 Bandipūr (3,300'); 725 ♀ 23-1-40 Bābābūdān Hills (4,500'—Kemmangundi); 798 ♀, 799 ♀ 1-2-40, 813 ♂ 2-2-40 Settihālli (2,500') *Biligirirangan Hills*: 19 ♂ 8-11-39 (4,000'—Bedagūli); ♂ imm., ♀ imm. 30-12-32, M55(H) ♂ 14-4-34, M29(G) ♂ 20-9-34 (5,000'—Honnametti); M67(H) ♂ 15-5-34 (4,000'—Shenemenhalla); M91(H) ♂ 19-5-34 (4,000'—Magoolibetta); M5(G) ♀ 14-9-34 (2,000'—Satyamangala); M52(G) 10-10-34 (4,000'—Bellaji); M8(G) ♂ 11-11-34 (4,000'—Attikān); M77(G) ♂ 23-7-34, M86(G) ♂ 25-7-34 (3,000'—Udahatti, E. base).

[Measurements:

	Bill	Wing	Tail
7 ♂ ♂	15-16.5	62-65	58-60.5 mm.
3 ♀ ♀	15.5-17	61-62	56-60 mm.

Some of the specimens are moulting wings and tail hence not measured.—H. W.]

Resident. Common. Affects evergreen shade trees in cardamom *sholas*. Found throughout the intermediate zone to its extreme deciduous boundary. Its characteristic posture on a branch is rather hunchbacked with neck telescoped in and tail depressed.

Tephrodornis gularis sylvicola Jerdon. The Malabar Wood-Shrike.

Specimens collected: 241 ♀ 1-12-39 Manchgowdanhālli (2,500'); 649 ♀ 16-1-40 Saklēshpūr (3,000'); 777 ♂ 30-1-40 Settihālli (2,500').

Elsewhere noted: Karāpūr, Jāgar Valley (2,500'—Bābābūdān), Āgūmbē, Jōg.

[Measurements:

	Bill	Wing	Tail
1 ♂	27	115	84 mm.
2 ♀ ♀	27	111.5-121	84-88 mm.—H. W.]

Resident. Common in evergreen biotope. Usually seen among shade trees in coffee and cardamom plantations. Also enters the intermediate zone and sometimes met with even in the dry-inter in old teak plantations and the like.

From the eye socket, trachea and pulmonary region of No. 241 were removed a number of the tissue-inhabiting nematodes of the genus *Diplotriaena* (Fam. Filariidae). The bird seemed none the worse for their infestation. As a matter of fact it was ready to breed (2 Decem.) with largest ovum 2.5 mm. diameter!

Tephrodornis pondicerianus pondicerianus (Gmelin) The Indian Common Wood-Shrike.

Specimens collected: 159 ♀, 160 ♂ 24-11-39 Maddūr (2,500'); 403 ♂, 405 ♂ 21-12-39 Mākliḍrūg (2,800'); 501 ♀ 29-12-39 Thōndēbhāvi (2,500'). *Biligirirangan Hills*: M45(G) ♀ 24-9-34 (2,000'—Satyamangala); M45 ?(G) ♂ juv. 17-7-34, M81(G) ♀, M84(G) ♂ 24-7-34, M95-96(G) ♂ ♂ 26-7-34 (3,000'—Udahatti, E. base).

Elsewhere noted: Bandipūr, Hūnsūr, Shimsha, Sivāsamūdram, Nāmada-chilumē.

[Measurements:

	Bill	Wing	Tail
3 ♂ ♂	20-22	88-91	65-67 mm.
2 ♀ ♀	20-21	82-89	63-66 mm.

The six Biligirirangan specimens which seem intermediate between *pondicerianus* and *affinis* i.e. much like Travancore birds, measure as follows (excluding moult and unsexed and juvenile):

[Measurements:

	Bill	Wing	Tail
3 ♂ ♂	20.5-21	88.5-94	64-66 mm.
1 ♀	21	85.5	63 mm.—H. W.]

Resident. Common. Confined to deciduous biotope. Met with in scrub and secondary jungle, frequently amongst the itinerant mixed hunting parties of small birds.

Pericrocotus flammeus (Forster) The Orange Minivet.

Specimens collected: 67 ♂ 15-11-39, 128 ♂ 20-11-39 Bandipūr (3,300'); 634 ♀ 15-1-40 Saklēshpūr (3,000'); 677 ♀ 19-1-40, 696 ♂ 21-1-40, 727 ♂ 23-1-40 Bābābūdan Hills (4,500'—Kemmangūndi). *Biligirirangan Hills*: 11 ♂ 7-11-39, 17 ♀ 8-11-39, 29 ♀ 9-11-39 (3,000'—4,000'); ♂ 22-12-32, ♀ 30-12-32, M12(H) ♂ 8-5-34, M22-23(H) ♂ ♂ 9-5-34, M58(H) ♀ 14-5-34, M75(H) ♀ 16-5-34 (4,000'—5,000'—Honnametti); M32(H) ♂, M34(H) ♀ 5-34 (4,000'—Chiksampagi); M67-68(H) ♀ ♂ 27-4-34 (4,000'—Dodsampagi); M9(G) ♀ 11-11-34, M13(G) ♀ 15-10-34 (4,000'—Attikān); M10(G) ♂ 12-11-34 (4,000'—Bellaji); M20(G) ♂ 17-10-34 (4,000'—Edbūthi).

Elsewhere noted: Devarbetta Hill.

[Measurements:

	Bill	Wing	Tail
13 ♂ ♂	17.5-20	90-96	88-97 mm.
12 ♀ ♀	17-19.5	89.5-96.5	86.5-93 mm.—H. W.]

Resident. Common. Typical habitat: Intermediate zone up to the outermost fringe of both its extremes.

Pericrocotus peregrinus peregrinus (Linn.) The Small Minivet.

Specimens collected: 68 ♂, 69 ♂, 70 ♀ 15-11-39 Bandipūr (3,300'); 307 ♀ 9-12-39 Hūnsūr (2,000'); 398 ♂ 20-12-39 Dodballapūr (2,900'). *Biligirirangan Hills*: M15(G) ♂ 9-7-34, M31(G) ♀ 13-7-34, M63(G) ♂ 20-7-34 (3,000'—Udahatti, E. base); M34(G) ♂ 22-9-34, M44(G) ♀ 24-9-34 (2,000'—Satyamangala).

Elsewhere noted: Maddūr, Thōndēbhāvi, Nāmadachilumē.

[Measurements:

	Bill	Wing	Tail
6 ♂ ♂	13-14	70.5-72	70-74.5 mm.
3 ♀ ♀	12-13	70-72	71-76.5 mm.—H. W.]

Resident. Not uncommon. Restricted to deciduous biotope. Flocks met with in light forest as well as in scrub-and-bush country interspersed with small trees. Frequently in the mixed hunting parties.

In the specimens of 9 and 20 December a slight development of the gonads was noticeable: testes 5×3 mm., ovary granular.

Lalage sykesi sykesi Strickland. The Black-headed Cuckoo-Shrike.

Specimens collected: 262 ♀ 4-12-39 Karāpūr (2,500'); 297 ♂ 8-12-39 Seringapatām (2,000'); 397 ♂ 20-12-39, 455 ♀ 26-12-39 Dodballapūr (2,900'); 525 ♂ 2-1-40 Nāmadachilumē (3,000'); 846 ♀ 7-2-40 Āgūmbē (2,000'). *Biligirirangan Hills*: M41(G) ♂ 23-9-34 (2,000'—Satyamangala); M43(G) ♂ juv. 17-7-34, M85(G) ♂ 25-7-34, M98(G) ♂ 27-7-34 (3,000'—Udahatti, E. base).

Elsewhere noted: Shimsha, Sivāsamūdrām, Saklēshpūr, Jāgar Valley (Bābābūdāns), Settihālli, Kolār Gold Fields.

[Measurements:

	Bill	Wing	Tail
6 ♂ ♂	18.5-20	102-106.5	78-83 mm.
3 ♀ ♀	18-19	100.5-103.5	78-79 mm.
1 ♂ juv.	—	96	72.5 mm.—H. W.]

Resident. Common. Restricted to deciduous biotope. Frequents scrub-and-bush as well as secondary jungle. This Cuckoo-Shrike has, however, a very general distribution in the State and is often met with in the deciduous facies of the evergreen, e.g. Saklēshpūr and Āgūmbē.

Graucalus javensis macel Lesson. The Large Indian Cuckoo-Shrike.

Specimens collected: 179 ♀ 25-11-39 Bandipūr (3,300'); 433 ♀ 24-12-39, 475 ♀ 27-12-39 Dodballapūr (2,900'). *Biligirirangan Hills*: M29(G) ♂ 21-9-34

(2,000'—Satyamangala); M61(G) ♀ 20-7-34, M114(G) ♂ 4-8-34 (3,000' Ūdahatti, E. base).

Elsewhere noted: Nāmadachilumē.

Measurements:

	Bill	Wing	Tail
2 ♂♂ ad.	28.5-29	161	117.5-120 mm.
2 ♀♀ ad.	28-29	164.5-167	122-125 mm.
2 ♀♀ imm.	27-28	153-154	119.5-121 mm.—H. W.]

Resident. Fairly common. Restricted to deciduous biotope. Affects secondary jungle and scrub country interspersed with large trees. Frequently wanders into the intermediate zone.

Artamus fuscus Vieillot. The Ashy Swallow-Shrike.

Specimens collected: 760 ♂, 761 ♀ 28-1-40 Settihalli (2,500' Biligirirangan Hills: 36 ♀ 10-11-39 (3,000'—Bedagūli); M8-9(G) ♂ juv. 8-8-34, M53-54(G) ♂ ad., ♀ juv. 18-7-34 (3,000'—Ūdahatti, E. base).

Elsewhere not noted.

[Measurements:

	Bill	Wing	Tail
2 ♂♂ ad.	22-23	131-134	54-56 mm.
2 ♀♀ ad.	21-22	135-136	58 mm.
2 ♂♂ juv.	—	132-136	58-59 mm.
1 ♀ juv.	—	135.5	60 mm.—H. W.]

Uncommon, patchily distributed and sporadic. Confined to deciduous biotope, but frequently met with in the intermediate zone in forest clearings and young plantations.

Dicrurus macrocercus peninsularis Ticehurst. The Indian Black Drongo.

Specimen collected: 220 ♀ 1-12-39 Antarsāntē (2,500').

Elsewhere noted: Chamarājanagar, Shimsha, Sivāsamūdrām, Marikānivē, Kolār Gold Fields.

[Measurements:

	Bill	Wing	Central tail	Outer tail
1 ♀ ad.	25	142.5	moult	143 mm.—H. W.]

Resident. Fairly common in flat open country about cultivation.

There is a local legend which I heard in the Kolār Gold Fields that if a drongo drinks out of the chatty that has been ceremoniously carried 3 times round a corpse on the cremation ground, and afterwards alights on the back of a grazing cow or goat, the animal's back breaks. Believe it or not, my informant, the local forester, has with his own eyes seen several cattle disabled in this way! For humanitarian reasons therefore it is customary to smash the chatty after the rites have been performed.

Dicrurus longicaudatus Jerdon. The Ashy Drongo.

Specimens collected: 712 ♂ 22-1-40 Bābābūdan Hills (4,500'—Kemmangūndī, Biligirirangan Hills: 12 ♂, 13 ♂ 7-11-39 (4,000'—Edbūthi); ♂ 17-12-32, ♂ 22-12-32, M49(G) ♀ 30-10-34 (5,000'—Honnāmetti).

Elsewhere noted: Bandipūr, Devarbetta Hill, Nāmadachilumē, Jāgar Valley, Settihalli.

[Measurements:

	Bill	Wing	Central tail	Outer tail
3 ♂♂ ad.	27	139-147	93-97	156.5-187 mm.
2 ♂♂ imm.	26.5-27	133-134.5	89-90.5	138.5-139 mm.
1 ♀ imm.	26	140	97	158 mm.—H. W.]

Resident. Fairly common—away from flat cultivation—in forest, both evergreen and deciduous, but chiefly in the intermediate zone. It was regularly observed eating nectar from flowers of the *Erythrina* and *Grevillea* shade trees in coffee plantations, and also from the white brush-like blossoms of *Eucalyptus* sp. wherever these trees have been introduced.

Dicrurus caerulescens caerulescens (Linn.) The White-bellied Drongo.

Specimens collected: 64 ♂, 65 ♂ 15-11-39 Bandipūr (3,300'); 404 ♂ 21-12-39, 419 ♂ 23-12-39 Mākīdrūg (2,800'); 513 ♂ 31-12-39 Nāmadachilumē (3,000'); *Biligirirangan Hills*: M(G) ♂ juv. 22-9-34. (2,000'—Satyamangala); M66(G) ♂ juv. 21-7-34, M82(G) ♂ juv. (3,000'—Udahatti, Eastern base).

Elsewhere noted: Shimsha, Sivāsamūdrām, Devarbetta Hill.

[Measurements:]

	Bill	Wing	Central tail	Outer tail
5 ♂ ad.	23.5-25	123-127.5	85-88	111.5-120 mm
3 ♂ juv.	—	121-123	85.5-89	113.5-119 mm
				—H. W.]

Resident. Fairly common in deciduous biotope. Typical habitat: Bamboo facies. Usually met with as a member of the roving hunting parties of insectivorous birds in secondary jungle.

From the body cavity of No. 65 two nematode worms (*Diplotriaeana* sp.) were removed.

Chaptalia aenea malayensis Blyth. The Southern Bronzed Drongo.

Specimens collected: 109 ♀ 19-11-39 Bandipūr (3,300'); 192 ♀ 28-11-39 Antarsāntē (2,500'); 807 ♀ 2-2-40 Settihālli (2,500'). *Biligirirangan Hills*: M5 (H) ♂—, M7(H) ♀ 26-3-34 (4,000'—Chiksampagi).

Elsewhere noted: Jāgar Valley (2,500'—Bābūdāns).

[Measurements:]

	Bill	Wing	Central tail	Outer tail
1 ♂ ad.	24	118.5	—	105 mm.
4 ♀ ad.	21-22.5	115.5-118	87-88.5	105-107.5 mm.
1 ♂ juv.	—	115.5	—	107 mm.—H. W.]

Resident. Common in the intermediate zone extending across to outer fringe of the dry-inter. Affects jungle, and usually found with the mixed hunting parties.

Chibia hottentotta londae Koelz. The Malabar Hair-crested Drongo.

Specimens collected: 527 ♂, 528 ♂, 529 ♂, 530 ♀ 2-1-40, 539 ♀ 4-1-40 Nāmadachilumē (3,000').

Elsewhere noted: Settihālli (2,500'—Shimoga District).

[Measurements:]

	Bill	Wing	Central tail	Outer tail
4 ♂	38-39.5	154.5-162	114.5-128.5	130-141.5 mm.
1 ♀	38	164	126	135 mm.

There seems no doubt—as hinted by previous writers—that the Hair-crested Drongo falls into two recognisable races in India differing in size. There is a large bird in the sub-Himalayan area from Baijnath (in the Kāngra District) to our border by the Brahmaputra river and Naga Hills, and a smaller race along the south-western Ghāts from Mahableshwar to Travancore whose range inland is now considerably extended by the present specimens. Between these two areas the bird is only found in a belt across the Chota Nagpur area from Nagpur to Calcutta, where it is apparently intermediate in size.

Reliably sexed specimens are not numerous and I cannot supplement these Mysore birds with any adult males from the southern distribution, but these 4 males are definitely smaller than 10 males from the Eastern Nepal—Naga Hills area which measure Bill 40-43, Wing 163-173.5. The only adult male I can measure from the Western Himalayas is even larger: Wing 179 mm.

As pointed out in the Eastern Ghats Survey (*J.B.N.H.S.*, xxxvi, 352) there has been some difficulty over the type locality which was given by Linnaeus in error as the Cape of Good Hope but later restricted by Mr. Stuart Baker (*Novitates Zool.* xxvi (1919) p. 44) to Sikkim, and this restriction, though rejected by Kloss (*Jour. F. M. S. Mus.* Vol. x (1921) p. 222), must certainly stand. It has since been accepted by Chasen (*Handlist of Malaysian Birds* (1935) p. 304). The larger northern form is therefore the typical race.—H. W.]

In the draft of his notes Mr. Whistler had proposed a name for this smaller southern race, but it appears that in the meantime Mr. Walter Koelz had already named it as above on specimens recently collected by him in the neighbourhood of Londa (near Castle Rock, Goa Frontier). Mr. Koelz's paper (*Proc. Biol. Soc. of Washington*, vol. lli, pp. 61-82 [5 June 1939]) was delayed from our notice owing to war conditions.

Resident. Not common and apparently of patchy and erratic distribution. The specimens were obtained from a loose scattered party of 8 or 9 birds feeding on nectar from the white brush-like flowers of *Eucalyptus (robusta?)* in a self-sown grove to which they appeared confined. Their throats and foreheads were coated with pollen and the bills dripped nectar. Their stomachs contained a small quantity of insect remains besides. The plumage of all the specimens emitted a strong musty odour of fermenting honey as from the crop of a Honey-Buzzard.

The only other example of this Drongo met with in Mysore State (Settiähalli, 30-1-40) was also on an *Eucalyptus (robusta?)* tree in blossom, growing in the compound of the Forest Lodge.

Dissemurus paradisicus malabaricus (Latham). The Malabar Racket-tailed Drongo.

Specimens collected: [133 ♂ 21-11-39 Gūdalūr Ghāt (3,000'—Nilgiris)]; 187 ♂ 28-11-39 Antarsāntē (2,500'); 647 ♀ 16-1-40 Saklēshpūr (3,000'); 754 ♀ 28-1-40 Settiähalli (2,500').

Elsewhere noted: Maddūr (near Gūndlūpet), Jāgar Valley (Bābābūdans).

[Measurements:

	Bill	Wing	Central tail	Outer tail	Racket
2 ♂♂ ad.	34-36.5	152.5-156.5	133-141.5	330-405	100-107 mm.
2 ♀♀ ad.	32.5-33.5	148.5-151.5	127.5-133	313-357	91-97 mm.

These specimens certainly belong to the form called *malabaricus*, but I have already pointed out in the Eastern Ghats Survey (*J.B.N.H.S.*, xxxvi, 351) that I find no real differences between *malabaricus* and the typical race. There is no doubt that too many races of this species have been described, but the group is difficult to understand, material is poor, the meaning of differences in plumage are hard to disentangle for lack of the right specimens and I do not think any revision of the races should be piecemeal.

The 2 females have the abdomen duller and faintly barred with white, the under-tail coverts are spotted with white and the spotting on the underwing coverts is heavier than in the males. These differences (which I have observed before in other specimens) seem to me to be sexual and not a matter of age. —H. W.]

Resident. Common. Typical habitat: Intermediate zone, primarily the bamboo facies.

(To be continued).

CIRCUMVENTING THE MAHSEER AND OTHER SPORTING FISH IN INDIA AND BURMA.

BY

A. ST. J. MACDONALD.

(With one plate and one text-figure).

(Continued from page 189 of this volume).

PART II.

I. THE SCIENTIFIC ASPECTS OF ANGLING.

A review of the fishes senses (342), Scientific explanations of the functions of the lateral line (343), Hearing (344), The eye and vision (345), The chemical senses of smell and taste (345), These views compared (347), How the Mahseer fits these theories (348), List of references (348).

Fishing, like all forms of sport, calls for an understanding of our quarry, and a few general principles should first be considered before hastening to the water's edge to wet a line. Judging from the casual conversations in a club or a bar, or from articles written to the press, there appear to be a great many anglers who know little or nothing about the senses of fish. It is for this reason that I think a short chapter on the senses of fishes will be found instructive and interesting; as quite apart from the method of approach while fishing, these senses, if understood, will help the angler in adapting his lure with better understanding, and give him better results.

The application of sight and hearing, or taste and smell, as we know them, are too readily applied to a fish, but the environments and elements effecting or governing these are not sufficiently borne in mind. The angler will pay great attention to the colour of his fly and its resemblance to the natural insect, but give little or no attention to the structure of the lure, wherein probably lies more than half the secret of success or failure. We will see later on in this chapter that the sight of fish is a secondary sense to feel, much as a tiger's scent is secondary to his sight and hearing.

Science has proved that the senses of a fish have developed on very different lines to ours, and that these must be adapted to the greater density of water might well be imagined. Water being incompressible, any displacement sets up pressure waves, which are quickly registered and detected by specially adapted organs provided in fish. These are of a highly sensitive nature and contained in the Lateral Line. How far the detection is minimised, if at all, in the disturbed and distorted waters of a rapid or fall, or how far such vibrations travel up-stream, is not clear, but provision

CIRCUMVENTING THE MAHSEER



The young novice aged 5½ years : my son with his first Mahseer 3½ lbs.



"White Feather" of water just above the figure.

must surely be made in the nervous system of a fish for differentiating between the natural and unnatural, much as the keen ears of a sambar do between the rustling leaves in the wind and those disturbed by a footfall.

How vibrations are transmitted or interchanged by the different elements I am not in a position to say; but a fire by the side of water certainly registers some form of signal to fish. I have seen this on the Surju, in Kumaon, when a pyre is lit, and where, I regret to say, mahseer are master scavengers. At Rewa, also, I have seen fish collect to be fed near a temple when a huge bell is rung. If you keep in mind the 'touchiness' of a fish, and adapt your methods accordingly, you will not be disappointed.

Neither Thomas, Lacey, nor Skene Dhu, deal with the functions of the Lateral Line, (which to me is the most important factor governing all approaches to angling), in fact most of the views expressed are misleading in their interpretation of the senses of fish.

I am fortunate in having with me J. R. Norman's excellent book *The History of Fishes* 1931, and J. E. Nielsen's interesting article *Angling has Scientific Angles* published in the 'Scientific American' in July 1934 Vol. 151 No. 1.

Norman's work is a highly comprehensive and technical survey of all fish, whereas Nielsen's article has been written in more popular language for the angler.

With the aid of these I will now deal with the senses of fish in order of importance, as applied to angling.

(1) *Lateral Line.*

'The lateral line consists of a series of perforated scales running along each flank in most of the bony fishes. It consists of a canal or tube sunk into the skin and opening to the exterior by a series of pores. There is a group of sensory cells beneath each pore, and these serve to give the fish impressions of minute differences in the pressure of the currents of water.' (3. p. 43).

'The sense organs of the lateral line are served by fine nerves arising from a special branch of the vagus (tenth) cranial nerve running parallel to the line itself, and conveying the sensory impressions to the brain. The lateral line system has generally been regarded as the seat of a sense akin to "feeling", but it would perhaps be more accurate to describe this sense as combining the qualities of hearing and touch.' (1. pp. 200-202).

'Hearing and feeling are closely related senses, and in the case of fish there is no definite border line between the two. In addition to periodic sound waves, there are other waves—non-periodic pressure waves, which humans cannot perceive. A worm wriggling in the water, or an insect falling on the surface will set up waves of pressure in the water around them: these will instantly be noticed by the fish. For this purpose it has an extremely suitable organ the "lateral line". As we ourselves do not possess this organ, it is difficult for us to imagine how its sensations feel, but there is no question that its sensitiveness is far superior to that of fish vision. This fact is affirmed by the strong lateral nerve system connected to it. The best analogy we can give is that of a blind man with

his stick, but the fish has long "sticks" in all directions, and every stick has a sensitivity equal to the tip of your tongue—every stick is in fact a "teletoucher". Most fishermen do not pay much attention to this organ, but it is nevertheless the organ which causes more bad luck among fishermen than all the other senses combined. With this organ, fish are able to feel the least "touchiness" in the surrounding medium.' (2. pp. 20-21).

In supporting the theory of the sensitiveness of the lateral line, and the acute feeling of a fish of anything foreign in the immediate medium surrounding it, it occurs to me that the Tank Angler may ask 'But what of paste bait or dead worms threaded on a hook—how is their presence registered to a fish?'

Here let me put forward my own theory, giving as an example the Vulture.

A few years ago, a long series of letters appeared in the press, on how vultures make contact with carrion. A great deal of controversy took place, and various views were put forward, but in the end it was generally accepted that sight was the only means of the vulture finding food. This was systematically led up to: flies attracting birds, and birds other scavengers, such as crows and kites, and these in turn attracting nearby vultures and so on.

This is exactly how I reason fish to react to ground bait in a tank. Small fish and turtles attract the larger fish near at hand, these in turn attract others within the registering range of themselves and so on until the fancied Rohu and Cutla arrives within the range of its chemical senses, and is so directed to the hook of paste or worms, the distance of diffusion depending on the flavour or smell of the bait used.

(2) *Hearing.*

'A study of the development of the inner ear shows that this must have been at one time one of the sense organs of the lateral line, before becoming specially enlarged and modified in order to adapt it to the perception of delicate sound vibrations, and to the maintenance of equilibrium.' (1. p. 201).

'In fishermen the ear is divided into three parts. The external, the middle, and the internal ear or the labyrinth. Fish possess only this latter part. The reason for this difference is clear. The function of the ear is to collect vibrations of various frequencies. In the case of humans the ear is surrounded by air, and the funnel-shaped external organ is an efficient device for collecting these vibrations, because the medium in which they are set up has a density of only one thousand of that of which the ear is built. Fish on the other hand are surrounded by a medium having the same density as that of which they are built, and their whole body partakes of the vibrations set up in this medium. The labyrinth is the only organ required to transfer the physical vibrations to the nervous system. As the receiving nerve centres of a fish are built much the same as ours, we may assume that its sense of hearing is similar to ours, possibly better, on account of the high density of water with which the nerve centres are in direct communication.' (2. pp. 20-21).

(3) *The Eye and Vision.*

'In its general form the eye of a fish is not unlike our own, but it is necessarily somewhat modified for vision under water. . . . The lens of a land vertebrate is somewhat flat and convex on both sides, but in the fish it is a globular body, the extreme convexity being a necessity under water because the substance of the lens is not very much denser than the fluid medium in which the fish lives.' (1. p. 185).

'In the human eye, light rays enter the first lens through the cornea, which contains a transparent fluid of refractive index the same as water, namely 1.33. Next it passes through the pupil to the second lens, which has a refractive index, of about 1.141. From this it proceeds through almost pure water to the retina, where the image is picked up by the optic nerve. This device of sight is highly efficient in air, which has a refractive index of 1.00, but when immersed in water, which has a refractive index of 1.33 it is very inefficient. The reason for this is that, as is shown by the principle of optics, light rays which enter the eye will then not be refracted by the first lens, but will go through to the second lens in a straight line, and this will have a relative refractive index of only $1.41 \div 1.33$ or 1.06, which is too low to make possible a sharp image on the retina. In order to improve upon the low refractive power of the eye of a fish, nature has increased the curvature of its only active lens to the maximum possible, which is the sphere. As we know from optics, the disadvantage of a spherical lens is that only the very central rays will give a tolerably clear image. It exhibits marked spherical aberration. This, combined with the low refractive index, makes fish very near-sighted animals. They are able to sense changes in light intensity . . . We may also see that a flash reflected from a shining spoon or wobbler may allure with the same power as the reflection from the side of a fish.' (2. pp. 20-21).

(4) *The Chemical Senses, Smell and Taste.*

'...which are separated in fishermen, are combined into one by fish. As the nature of smell is to perceive odorous matter highly diffused in air, and as fish are not surrounded by air, there can be no sensation of smell as it is known in fishermen. There may however, be a better developed sense of taste, judging from the abundant distribution of taste buttons in and around the mouth, and on the side of the head. It is possible that fish can taste matter highly diffused in water as easily as we can smell it in air. Taste and smell are quite different sensations. It is only occasionally that an agreeable smell arouses our desire to eat. Some fine perfumes, for example, have a definitely disgusting taste. The practice of some fishermen, of perfuming the bait is useless and unscientific'. (2. pp. 20-21).

In relation to the theory set out on the chemical senses, as interpreted by Nielsen, Norman dealing with the olfactory organs states:—

'...the sense of smell resides in the nasal or olfactory organs, but, unlike the higher vertebrates, the nostrils or nasal openings are never (or scarcely ever) used for breathing purposes. Typically, each nasal organ consists of a somewhat deep pit lined with special

sensitive tissue, and in order to provide the maximum of sensitive surface, the lining is generally puckered up into a series of ridges which may be parallel to each other, or arranged in radiating fashion like a rosette . . . In bony fishes both nasal pits are divided into two separate portions, each with its own opening to the exterior. The position of the nostrils varies considerably in different fishes. In some the anterior nostril is widely separated from the posterior, in others the two are almost in contact. Occasionally, as in the Cichlids (*Cichlidae*) and in certain Wrasses (*Labridae*), the nasal organs each have only a single external orifice. In some of the Eels (*Apodes*) the anterior nostril is situated on the upper lip (labial position) and in many of the globe-fishes (*Tetrodontidae*) there are no actual apertures but a pair of solid nasal tentacles . . . There can be little doubt that the sense of smell in fishes is relatively acute, as has been proved by numerous experiments. The large nasal organs of sharks are said to enable them to "Scent actively as well as passively", and it is well known that the smell of flesh or blood or of a decaying carcass will attract them to it from some distance away. The Caribe or Piraya (*Serrasalmus*), the ferocious Characin-fish of the rivers of South America (cf. p. 130) is irresistibly attracted by the smell of blood, and woe betide the animal unfortunate enough to be bitten by one of these pests, for hundreds more will rush to the spot with incredible rapidity. As long ago as 1653 Izaak Walton wrote the following in his '*Compleat Angler*' with reference to the sense of smell of fishes. 'And now I shall tell you that which may be called a secret. I have been a-fishing with old Oliver Henly, now with God, a noted fisher for trout and salmon; and have observed that he would usually take three or four worms out of his bag, and put them into a little box in his pocket, where he would usually let them continue half an hour or more before he would bait his hook with them. I have asked him his reason and he has replied: 'He did but pick the best out to be in readiness against he baited his hook the next time' but he has been observed, both by others and myself to catch more fish than I, or any other body that has ever gone a-fishing with him, could do, and especially salmons. And I have been told lately, by one of his most intimate and secret friends, that the box in which he put these worms was anointed with a drop, or two or three, of the oil of Ivy-berries, made by expression or infusion; and told that by the worms remaining in the box an hour, or like time, they had incorporated a kind of smell that was irresistibly attractive enough to force any fish within the smell of them to bite'. Mention may be made of a number of careful experiments conducted by Mr. Gregg Wilson at Plymouth at the end of the last century, with a view to ascertaining the respective parts played by the sense of smell sight, etc., in obtaining food. He concluded that 'fish that are not *very hungry* habitually smell food before tasting it', but, when really ravenous, Pollack would bolt clams that had been saturated with alcohol, turpentine, chloroform and other unpleasant substances without any hesitation. He also states that in many cases the fish actually search for the meal by sight alone, and then test the quality of what they have found by smelling it. Some blind specimens of Pollack however, were able to find their food by smell alone, and there are doubtless other forms

which do this habitually, especially those dwelling in muddy or foul water, where the eyes would be of little use. The Cod (*Gadus*) is generally believed to feed more at night than in the day-time, and may rely largely on its olfactory sense. Mr. Gregg Wilson has shown that the Dab (*Limanda*) is normally a sight feeder, but under experimental conditions, if a number of worms were placed in a small wooden box with minute apertures to allow the water to pass in and out, considerable excitement was immediately produced, and the fish hunted eagerly in every direction.

'When water in which many worms had lain for some time was simply poured into the tank through a tube that had been in position for several days, and by a person who was out of sight of the dabs, the result was most marked . . . Yet there was nothing visible to stimulate the quest.' From the above and other sources of evidence it may be concluded that the sense of smell plays a fairly important part in the daily life of a fish, and although as a general rule this is not the only sense upon which it relies to obtain a meal, if the eyes or ears should in any way fail to function it could probably be induced to search for its food by smell alone.' (I. p. 182-185).

From the text of these extracts, it will be seen that agreement in all the views quoted is evident, except in the chemical senses of smell and taste, which is by no means conclusive.

From the anglers point of view there is little to distract us from the theory or methods to be applied or followed, as both these senses are so closely related, that even were we to follow one theory or the other in principle, we would still find ourselves proceeding on much the same lines. For taste or smell acting as a secondary sense to that of feel, or the functions of the lateral line, would be applied by the fish to our lure in a similar manner.

It is interesting, however, to compare how these two authorities approach this subject, and from a purely practical stand point I think one explains the other.

J. R. Norman dealing with the functions of the nose says,

'In order to provide the maximum of sensitive surface, the lining is generally puckered up into a series of ridges, which may be parallel to each other or arranged in radiating fashion, like a rosette.'

He goes on to say that in some fishes the nostril actually communicates with the roof of the mouth. Nielsen on the other hand states:

'Smell and taste; which are separated in fishermen, are combined into one by fish. As the nature of smell is to perceive odorous matter diffused in air, and as fish are not surrounded by air, there can be no sensation of smell as it is known by fishermen . . . It is possible that fish can taste matter highly diffused in water, as easily as we smell it in air'.

These would indicate from our point of view that whichever is correct the functions of the nose or taste 'buds' or 'buttons', in relation to finding smelly or scented bait, are so closely related that no difference arises, nor does it call for any change of method for one or the other.

The tank angler who applies high or smelly cheese to his bait is convinced that it is smell that attracts the fish, whereas if it

were to be analysed it might quite easily prove to be taste, and so also in the experiments as quoted by Norman in connection with blood, rotten meat and ivy berries. It is too deep a subject for this little book, and is a monopoly of the 'pundits' of Science.

I have taken the liberty to quote freely from these two authorities (Norman and Nielsen), so as not to leave any doubt in the reader's mind about the authenticity of the various functions of the fish's senses, and to make available for the average angler facts about fish that would not ordinarily come his way.

I will conclude by summarising these senses as applied to the mahseer, to which this book is chiefly devoted.

(1) *Lateral Line*. The mahseer has larger scales than most fish, with a bold and well defined lateral line, so that it is reasonable to presume that it is well developed, and the functions attributed to it are keen, and that it is probably the chief sense by which this fish is attracted to a lure.

(2) *Hearing*. This is closely related to the lateral line, and its functions are probably absorbed into it, having a specific purpose, of separating certain vibrations. Its sensitiveness is probably as keen as the human ear.

(3) *The Eye and Vision*. The eye of the mahseer is bold and large, but his choice for rapids and broken water, especially when feeding, would indicate that his vision must be limited considerably and subordinated to the more highly developed sense of feel.

'... experiments have shown that the sense of sight probably plays the most important part in the search for food, but at the same time, this is much more limited than that of a land vertebrate; and, owing to the general haziness of the water, due to the presence of organisms and other matters suspended therein, objects must appear of somewhat uncertain outline. The extreme convexity of the lens of the eye points to the fact, that a fish is near-sighted, and even in the clearest water it is doubtful whether the range of vision exceeds about 12 yards, if as far as this. It is not unlikely that the fish really notices movements or changes in outline rather than in actual objects.' (1. p. 190).

(4) *The Chemical Senses*. I have already dealt with these, so far as they concern angling.

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II. ELEMENTRY NOTES FOR THE NOVICE.

'Have you gazed on naked grandeur where there's nothing else
to gaze on,

Set pieces and drop-curtain scenes galore,
Big mountains heaved to heaven, which the blinding sunsets blazon,
Black canyons where the rapids rip and roar?

*Have you swept the visioned valley with the green stream streaking
through,*

*Searched the vastness for a something you have lost?
Have you strung your soul to silence? Then for God's sake go
and do it;*

Hear the challenge, learn the lesson, pay the cost.'

R. S.

Mention of the Mahseer and its Gameness.—We will set aside all comparisons of the mahseer's gameness as compared with the salmon, sea trout, or any other 'game fish'. In India, anyway, pride of place goes to this fish, be it on a light fly rod or a strong 12-foot spinning rod, it affords the chief sport for the angler in India. I estimate that with reasonably light tackle (that used for trout or salmon) the mahseer gives fight at approximately 2 to 3 minutes per pound of weight, and this, should the reader wish to make comparisons, will be a rough guide. I have killed a 75 pounder in 40 minutes, and it has taken me one hour and twenty minutes to kill one of 23 pounds. But these are isolated cases, and for an average reckoning with the fly rod, I think my estimate of 2 to 3 minutes per pound of weight will not be found far wrong.

The mahseer is to be found throughout India and Burma, where rivers are suitable or large lakes fit his environments. Rivers must rise in the hills, be perennial, with rocks, rapids, and deep pools, for this fish to thrive. Some of the canals in the Punjab and U.P. also hold this warrior, especially if there are falls and fish ladders. An interesting thing about the mahseer is that his fin area is greater than the total superficial area of the rest of his body. This makes him a strong and powerful fish, able to live in the big and heavy waters of Indian rivers, in fact no water is too strong to hold him. My own experience with both fly rod and heavy spinning rod has convinced me that for fly spoon work, 150 yards of line is necessary, and for heavy work 300 yards. Time and time again I have needed the extra 50 and 100 yards, and then had to follow down stream, sometimes as much as 300 yards to kill my fish. Anyone who has caught mahseer knows what the first rush means, but by the novice or beginner this cannot be fully appreciated until experienced. I have heard it aptly described as terrifying, and it can be. Your arms are nearly torn out from their sockets, and all the skill and experience you may have will be needed to keep up the point of your rod. I refer to heavy fish in heavy water. On the fly rod the same rush is made when the bait is taken, and you are left guessing and estimating the size of the fish, but you will often be disappointed when at the end of the fight you see a game little chap of 3 pounds in the landing net, that you estimated at ten. This has been my experience of the mahseer, I hope it will be yours.

Tackle.—I will try to assume for the novice exactly how I felt when a beginner and pose myself as the instructor, with some 22 years experience. We will start with a well-equipped library of books and catalogues, a small banking account with both 'thrif' and 'extravagance' as the brother pupils, and with my own tackle outfit on view. For the beginner I think that the light fishing will hold out far more attraction and bring earlier success than the

more skilful and laborious methods required for the heavy fish. For the two methods are as unlike as salmon and trout fishing, and can be compared to the 'Scatter Gun' and rifle as to results. The heavy rod in six or seven hours fishing may only produce three or four runs, and quite often not one, whereas the fly rod will generally produce some fish, if not small mahseer then the sporting little *Barilius bola* commonly called Indian Trout or one of his many cousins. I will mention in order of importance what I consider the essentials and with them my suggestions.

The Reel.—This is the most expensive item, but also the most important, as cheap reels will be a constant worry, with springs snapping, bearings seizing, plates jamming, etc. and lots of fish and tackle being lost. A good reel will cost, upwards, from Rs. 40 to Rs. 140. That is one with a good foundation, only to be found in the higher priced reels. Bearings of gun metal or the other improved alloys, the spindle firmly set, the ratchet well fixed, and the check spring strong in paying out, but free or just engaging when winding in. If you stipulate these essentials to your tackle dealer, you will have got as near the perfect reel as possible. I do not stress a well fitting drum, or the avoidance of prominent nuts, handles, levers etc., as the manufacturers know well these are to be avoided for fly reels, as they foul the line and breakages occur. The check should be adjustable, as it can then serve for both light and medium work, but it must be strong enough to hook the fish without any pressure by hand. You cannot apply hand pressure on the line for mahseer, as he takes with such a rush that you will cut or burn your hand or fingers if you try. The size should be near the correct weight for your rod, but it must be large enough to take 150 yards of line and backing, unless of course you are only likely to fish in very small streams.

I am trying here to fit one reel to the universal use of Indian rivers, keeping 'thrifty' ideas in mind. I will not mention any special makes of reels, as there are dozens on the market today, and it is your business to find the most suitable one fitting these points, at the cheapest price, bearing in mind that cheapness does not always spell economy.

I am exclusively equipped with Hardy's reels, and use a Hardy's Silex $3\frac{1}{2}$ inch, but even so I have to take the reel down after each run, to tighten up the four screws fixing the ratchet to the drum. I understand however, that this has been partly overcome in the more recent and improved Silex. Mine are eleven years old!!

The Rod.—This is rather more difficult to advise on as rods are made in degrees of pliability, and are today reduced to a mathematical fine art though, I am sorry to say, nothing has been put on the market, to my knowledge, to fit the Indian fishing. Dry fly rods are generally the most suitable, as they are stronger built, and stand up to fly spoon work better than wet fly rods. I fancy split cane, but green-heart and steel rods are also good. It has to be borne in mind, however, that in some of the very hot, moist valleys, in parts of this vast country, split cane may not be suitable. The universal fly spoon rod, should be between nine and ten feet long, in two or three pieces, with a spare top, and with agate or chromium steel rings at the butt and end, with good strong steel

intermediate rings. (agate rings should be frequently examined under a magnifying glass, as they are apt to crack.) It must be capable of throwing a fly spoon up to one inch (2 drachms in weight) and *most important of all*, be capable of recovering the spoon in fast heavy water, as this is when a rod is most severely tested. It must also be light and pliable, so as to give play to a fish of a pound weight and be capable of standing up to a fish of 20 pounds in exceptional cases. *Do not touch steel centres*, as they are not suited to the Indian climate. A good rod will cost up to Rs. 200 but there are lots partly fitting these requirements for Rs. 40 or Rs. 50 in green-heart, steel and cane, so that your choice must be governed by the price you are prepared to pay. I use a 'Perfection' two piece double built split cane rod, 10 feet in length built by Hardy's but it is too light for casting anything over $\frac{1}{2}$ a drachm in weight. For the heavy fishing a 9 feet 6 inch to 10 feet 6 inch spinning rod, will fit the requirements of all water, and as long as agate and porcelain rings are fitted and the rod has a certain amount of give down to the handle, it will cast a large spoon with a heavy weight, as well as spoons of $1\frac{1}{2}$ to 2 inches and will stand up to any size of fish. Even shorter rods of 7 ft. with the American casting reels are very popular, and large fish have been taken. The more pliable the rod the better it is for striking a fish.

I use a 9 ft. bamboo rod built by Verona, to my specifications and is all that is desired, and well within the price of most anglers, Rs. 30. I have besides an 11 ft. split cane spinning rod by Hardys, for very big water where fish run over 50 and 60 pounds. The range in price for these two rods is Rs. 30 to Rs. 250.

The Line.—Braided silk dressed lines are the best value, and last indefinitely if cared for and dried daily after use. Water-proof and enamelled lines do not do well in this country, they are besides expensive and a constant source of worry and trouble, getting tacky and brittle in our varied climate. Tapered lines are attractive to use, but with a fly spoon sufficient weight is provided for long casts, so the ordinary graded line is good enough. 'Lignum Vitae' or 'Non Pareil' is what I use with a flax braided line or 'cutty-hunk' as backing. Grade 'H' with 14 pounds breaking strain for fly spoon work, and grade 'E' or 'F' for the heavy fish with a breaking strain of 24 and 30 pounds, respectively. Backing should be slightly stronger than the dressed line, so as to provide a margin of safety should a break occur.

Traces. *Natural Gut* is the most popular, and what I personally favour for fly spoon work, but it is expensive and difficult to come by these days. 'Medium Trout' to 'Sea Trout' sizes are strong enough for fly spoon. A good length of trace is 5 to 6 ft.

Gut Substitute has its supporters, and is both strong and convenient to tie into casts or traces, but knots must be very carefully tied as they have a tendency to slip. Durofix applied to the knot holds well, also to prevent the knot drawing or slipping, lay a piece of thin soft copper wire alongside one of the strands of gut substitute, and tie it in with the knot.

Wire, Killin and other similar makes of wire make up into excellent traces and leave nothing to be desired. It is made in

5 sizes 1x, 2x, fine, medium, and strong, of 8.12.15.20, and 25 pounds breaking strain. It is almost invisible in water, when new.

Alasticum is a new elastic steel wire, made in much finer grades and with a breaking strain down to 5 pounds, which is as fine as hair and should be excellent for light work. Avoid gimp or twisted wire, as it sets up friction in water, and is liable to kink.

Swivels.—Use the finest sizes, nos. 8 to 10. Three to a trace of $1\frac{1}{4}$ yds. in length in any grade of wire for heavy fishing. Learn to tie your own traces as it saves both expense and time, wire can be changed on to the same swivels in a few moments. Knots for tying gut traces and twisting wire will be discussed elsewhere in this book under 'Tackle'.

Lures.—Spoons vary in shapes, sizes and colour, almost as much as flies, so that one's fancy must be largely a matter of local choice as certain spoons suit certain localities. Remember that it does not follow that spoons of small size will only catch small fish, and large spoons large fish. I have caught on a $\frac{3}{4}$ inch fly spoon scores of fish over 20 pounds, and one of $29\frac{1}{2}$ pounds, likewise on a 4 inch spoon fish of only a pound and a half. Shape and spin more than the size, is the deciding factor. I myself fancy as a general favourite a long narrow spoon shallow in depth, with deep scales cut into the convex side for the larger sizes as on the Myitkyina spoon, and just a plain surface for the smaller sizes in fly spoons; but remember what I have written in Chapter V about spoons in general.

Hardy makes an excellent semi-hogbacked spoon in three sizes and for neatness and finish these cannot be surpassed. It is an excellent example to follow if you mount your own spoons.

For the many other lures such as Halcyon spinners, Phantoms, Pennell, Devons, fly minnows and insects etc., all take well and I recommend a variety to be carried and tried, if spoon fails. These patent spinners are beautifully turned out and come through the water in a most natural fashion, and do not tax a rod nearly so much as a spoon in heavy water, being much easier to recover; this also applies to the larger sizes for heavy fish.

Plug Baits.—In recent years these have come very much into prominence and are now more popular than spoon in a number of localities. The American makes are the most favoured, and are made in one or two pieces. The one-piece is favoured for heavy water, and the jointed two-piece for slower runs. They are beautifully turned out and are very natural in water but the trebles must be changed, they are only made in the larger sizes for big work, and special mahseer hooks must be fitted.

One great feature in favour of plug bait is that they float, and do not consequently get hung up nearly so often as spoon in shallow bouldery rapids if a bad cast is made. They also provide a good substitute for dead bait when not procurable. The shield set on in front and below the head takes a remarkable hold of the water, and keeps the bait well under while fishing. The colours and types should be suited to local conditions.

Dead or Natural Bait Mounts.—Crocodile and Archer spinners are the most popular mounts for dead bait, but there are also many others, the leaded variety are good if spinning is being done in

very big water. The best of all mounts however, and the least visible, is the threaded wire two-piece mount as described by me elsewhere in this serial.

Leads.—These are made in a number of shapes and sizes, but I do not recommend any permanently fixed lead on a line, as more fish are lost in this way than any other. The type I favour is the barrel shape, with a hole through the length, so that a strong piece of silk can be used to fasten it to the swivel of the trace, which would snap if it was fouled in a snag. The spiral or other types of lead may be used where rivers are not full of large boulders and snags. They are easy to attach, and do not foul the line or trace.

The bullet shaped 'Hillman' lead, is very quickly attached to the eye of a swivel, and weights can be speedily changed to suit varying water. This is especially useful when fishing from a boat or coracle, and changes of lead have to be quickly effected.

Hooks.—Only use the best hooks on which ever line you may have, as the crushing power of the mahseer is phenomenal. I have avoided any mention of fly or fishing with fly; it is far easier for the novice to learn how to cast a small spoon than a fly, besides which I am anxious to get him into a fish as early as possible, and the chances for this are far greater with spoon. There are dozens of good books on fly fishing, so that any mention here would be superfluous.

Casting with Fly Spoon.—We will assume that you have assembled your rod correctly, reel put on with right hand wind (an orderly or servant invariably puts it on the wrong way), the joint of the rod well home, and the line threaded through all rings (an attendant will often miss one out), the trace correctly tied to the line. Remember a knot is the weakest part of the line. A loop made at the end of a line, and passed through the swivel and over the spoon and trace, then pulled tight, is the surest and strongest and what I use for both light and heavy fishing. The figure of eight knot does just as well but is not as strong.

Attaching the spoon to trace.—If you use gut the same attachment as I recommend for attaching the trace to the line will do. Put the loop through the eye of the swivel on the spoon, then over the spoon and draw tight, this gives you a double gut lead for a couple of inches and stands up to the wear and strain of both the fish's lips and the spoon spinning. *Avoid above all things* attaching swivel to swivel, as all the advantage of fishing light is lost if you have a chain of swivels leading your spoon. I use the smallest of swivels, and if fishing with fine wire and fly spoon, attach a small swivel to the end of the trace, and a split ring on the fly spoon, the spoon is easily attached or changed, and for fly spoon work split rings can be used with safety if kept oiled and free from rust. If solid brazed rings are preferred a fine attachment link may be used.

Casting the Spoon.—If you have fished for salmon, use the fly spoon in the same manner as you do a fly, casting across and slightly below you, while feeling the spoon all the time, allow it to work across and below you until it has straightened out the line, then draw it up through the swirls and eddies formed on the edge of the fast water. But for the beginner, we must be more explicit, as the whole casting operation has first to be mastered.

Grip.—The grip with either hand is the same, find the point of balance on the handle, with the fingers around and the thumb above and along the grip raise the rod and take the point back until the rod has travelled as far as it will go, with the wrist bent, the elbow close into the side, and the hand in line with the shoulder, which will bring the hand with the thumb under and along the grip, and the fingers above and around it. This is at the peak of the backward movement of the cast; only practice will teach you the correct time to pause, before the forward movement is started, which is when the line has completed the arc and has straightened out behind you.

The forward movement is a combined harmonising of the wrist, arm, and shoulder, the arm carries the wrist forward in the direction of the cast, with the shoulder moving slightly forward, and the wrist straightening out as it moves forward, the weight of the rod is taken on the first finger, and the thumb free and just clear of the rod at the end of the cast. This roughly is the action, and must be the first stage of learning. The beginner finds the timing difficult, but once the correct pause is made, the rest follows.

There are other important points to be considered. Unlike the fly, the spoon grips the water, and the first and most important action before recovering, is to raise the point of the rod slightly, so as to bring the spoon to the surface before attempting to start the backward movement, which is a brisk recovery by the wrist, arm and shoulder, of the rod into the first position described, sending the spoon back and past you, more or less in the same line as the point of the rod, which should be held in a vertical plane to the water. When this has been mastered a longer line should be tried, but here the other hand will come into play, by drawing the line through the bottom ring while bringing the spoon to the surface, just before the backward swing. This shortens the lead, and is released when the forward swing is half way through. Important things to remember are :—

(1) Never point the rod down stream, but keep it as near to right angles to your line as possible. This is what the rod is for, to take the sudden strain, and spring the whole action of the gear into operation, which hooks your fish and reduces the shock on all the units of the outfit, while keeping a steady pressure on the fish all the time. As an example: get an attendant to hold your rod, with it pointed at you, draw a few yards of line off the reel, then repeat the same thing with the rod at right angles, and see the difference in tension.

(2) Keep feeling the spoon from the time it touches the water, until you recover it again; you will miss fish if you do not.

(3) Keep feeling your line to see it has not fouled either around the tip of your rod, or around the reel or handle. The best fishermen experience this, especially if a wind is blowing.

(4) Recover the point of your rod as soon as you strike a fish, and keep it up, for slack line, even for the fraction of a second, will lose fish.

(5) Do not try to hurry your fish, or drag him into the net. Mahseer have very leathery mouths, and the hook is easily torn out. Remember my estimate of 2 to 3 minutes per pound weight.

(6) Keep your finger and hands clear of the line; or you will regret it. Strike the fish from the reel, and of all things avoid braking a fish in its first rush, or you will lose more than you catch.

(7) If wading or in water, do not move until after you have recovered line, and after the fish has made its first rush, then work your way out of the water and play him from below, so as not to disturb the water above.

(8) When landing a fish, bring it into the net, do not allow the attendant to bring the net to the fish, this generally ends in disaster; if you are fishing with more than one hook, try to shelve your fish, as quite often a fish is hooked outside the mouth by only one of the two trebles, and the net may get fastened to the loose hook, and you will lose your fish.

(9) Kill your fish if possible at once, but it does sometimes become necessary to keep them alive, if the weather is very hot and fish are taken early in the day, and you are moving camp. A cord passed through and around the gills and tied to a boat, will keep the fish alive and frisky. If you have a good day and have more fish than you require, the smaller ones can be put back into the river.

The nine points enumerated above, are general to all types of fishing and item (7) is general to Indian fishing, as few rivers in India can be commanded from either bank, and wading is necessary to get out to good water.

So far we have considered what is the common method of fishing, that with the fly rod, which will also serve us on 'home leave'. We will now consider the other point of view, and fit 'extravagance' ideas.

Stationary drum reels and outfit.—This is commonly and better known as 'Wanless' or thread line tackle. To all who use it, it proves attractive and has the charm of being of the lightest material. A short casting rod of 5 to 7 ft., a highly mechanical reel, that has its mechanism revolving around the drum, with a multiple wind in, and a thread line with a breaking strain of from 9 or 10 pounds down to one pound. Once you have acquainted yourself thoroughly with the mechanism and working of the reel, the rest is simple, as you can make a cast in any manner you wish, flick it out, swing or cast over your head, without any fear of overrunning, which is the chief objection against the revolving drum types of reels. The smallest of baits can be thrown out considerable distances, and with practice a high degree of accuracy can be obtained. There are a number of good makes on the market, and being fully explained in the various catalogues, details of manipulation are therefore unnecessary. I have not myself tried one, so cannot offer comment one way or the other for either choice or use. A possible disadvantage with so fine a line is, that it may snap or cut easily, in heavy water and snags, there must also be a tendency to kink as with the Malloch reel, but it has proved itself suitable for large fish in many parts of India.

Revolving drum reels and outfit.—This is the more general method, and is covered by a large range of rods, reels and baits, varying from 7 to 12 ft. rods, and reels from 4½ inches to 3 inches.

The American wide drum reels, with a line guide and a quadruple multiplying wind, are very popular and used extensively with plug-bait and the short rod; they are far cheaper than the English makes and are easy to use. Full instructions are issued with each reel. For those who prefer the larger reels of British make, and price is not a consideration, there is a large choice and almost every tackle maker has one or two to offer. The best known are the 'Silex' and 'Easy Cast', but any reel of the Nottingham type works well if good material is put in. I use a Silex, so will give a short description of how to cast and fish with one, but the methods for casting in general are the same for all reels, provided the correct adjustments are made, and the makers' instructions are carefully followed. Spinning rods are made stiffer and stronger than fly rods, to suit casting a bait from one to five ounces, with good strong and wide rings to reduce friction on the line, so we must adapt our methods accordingly.

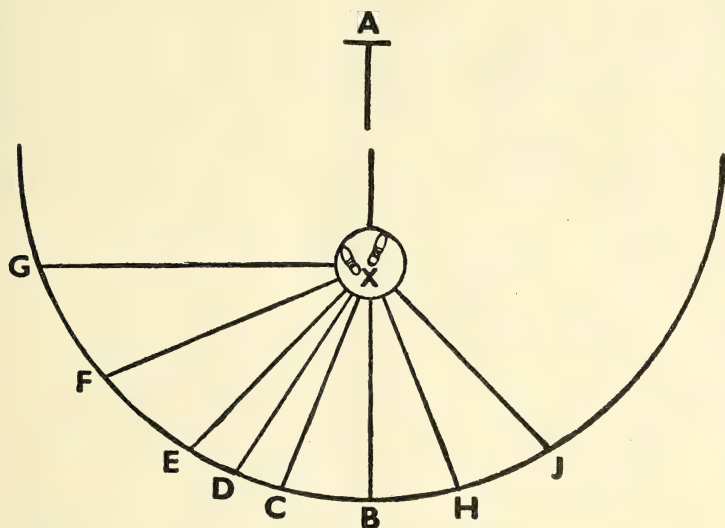
This is a double handed operation, calling for good control and timing throughout the whole movement, and is probably the most difficult to learn, but once mastered is most fascinating.

The rod is held in both hands, one behind the reel and one in front depending on whether you are right or left handed.

For example we will take a right handed cast. The right hand operates the clutch lever on the Silex with the forefinger pulling it up as far as it will go, so disengaging the check ratchet, and leaving the drum to run free. With the lever in this position, a felt friction pad is brought up against a metal drum connected to the line drum, and keeps up a pressure to prevent the line drum overrunning when the bait has touched the water. Correctly used and adjusted, this stops the line drum, but if the action of the cast is badly made, there is a tendency to overrun and the line gets entangled on the drum. Flicking the bait out, or putting too much 'beef' into the cast will cause this. A smooth easy action from start to finish, in the form of a good shot at golf, best describes the action. If correctly made the bait goes out in a straight line, and leads the lead and trace, and no effort is required. The moment the drum stops revolving (which should be as the bait hits the water), the clutch lever should be released, when the check is automatically engaged, and is ready for any emergency. This roughly is the operation of the reel, but now we must consider the cast itself, and how it is done. Here I will quote from Hardy's *Angler's Guide* and reproduce the diagram.

'Holding the rod at an angle of 45 degrees, allow a length of about $1\frac{1}{4}$ yards of line or trace to hang from the point to the bait. In casting, the movement of the body should be the same as driving in golf, a clean follow through stroke. Jerky casting makes overruns. Please refer to diagram. The Angler is standing at *X* facing *A* where the bait is desired to fall. Turn the body round, until facing *B* merely raising the left heel a little. Swing the bait slowly back pendulum wise to *C*, *D*, *E* or *F*, according to the weight of the bait, and make a cast from any of these points, pressing lever as the cast is made, and keeping it pressed until the bait falls on the water. This is all that is required. The bait is merely swung backwards, and at the same moment

as the cast is made, the lever is pressed quietly home. The movements of the initial stroke of the cast, and the pressing of the lever should be simultaneous. When using light baits 4 to 6 drachms, cast from *D*, *E*, or *F*. For baits weighing $\frac{3}{4}$ to $1\frac{1}{2}$ ozs., from any point *C*, to *H*. Diagram shows how to cast from the right side. If casting from the left the position is simply reversed'.



The procedure then is much the same as mentioned under fly spoon fishing, let the bait come across and below you, and wind up through all likely water, and repeat the cast.

Remember the following points :

(1) Get the reel correctly adjusted to your bait, before making a cast, and again each time you change your spoon or bait. This is most important.

(2) Do not release the lever until the drum has stopped revolving; this is a common fault, and it is frequently used as a check. The reel will soon wear out if you do.

(3) Be careful to wind the reel evenly with line; if it forms a ridge, the coils become loose and entangled, trouble follows, and both temper and fish are lost. This frequently happens when playing a heavy fish, or winding in against strong water.

(4) Before casting, make sure the line is free and not twisted around the tip of your rod, or you may damage the tip, or hook yourself or an attendant, especially if fishing with heavy bait and weight.

(5) A good guide when casting is to point your left shoulder at the point you wish to drop your spoon, and let your hands and arms go back as far as they can, making this the limit of the backward body movement.

Where to look for Mahseer.

Rivers.—We will take for choice a river in the lower Himalayas or Siwaliks, where for our purpose we will find all the ideal conditions, both for mahseer from a quarter of a pound to five score or more, and an easy hunting ground for the beginner. Twenty miles or so after the Indian rivers leave the hills, they start settling down into a monotonous and easy flow over sand, and from our point of view have little attraction. We must have the essentials which mahseer demand, rapids, pools and rocks.

My own choice is water near and about where the river leaves the last range of hills, especially where large pools are formed and the stream breaks up into a number of channels. If to these conditions we can add two or three junctions of spring fed tributaries, we have the ideal river. Most of the rivers of any size in the north of India rise in the snows: by 'spring fed' rivers I mean rivers that rise in the lower ranges, which are not subject to melting snow in the hot months of April and May.

Rivers which have their sources in the Western Ghats of India and the Highlands of Central India are not snow-fed. Of these the more important are the Nerbada, Godavery, Kistna, Bhima, Tungabadra, Cauvery and Bhavani, all of which hold mahseer, as also do the many fine artificial lakes in the Bombay Presidency. The record mahseer 119 lbs., and the next largest 110 lbs., were both taken in Mysore rivers, the former in the Cauvery and the latter in its largest tributary, the Cubbany (Kabani).

I will now generalize on the best places to fish, but I warn the novice, that this is much more a matter of keen observation and experience than a rule.

(1) Junctions of rivers, especially if there is a difference in temperature of the water in the two streams, (in May this can vary as much as 8 degrees), or if the parent river is discoloured by melting snow, or best of all if the small fish are migrating up or down stream. If one or two of these *desiderata* prevail, you can usually count on a singing reel for most of the day, as under these conditions it is not unusual to see a black mass of fish collected in the warmer and clearer water. If the small fish are running, you need only watch the water to see the little chaps scatter in all directions as the big fish take their toll.

(2) Rapids will present themselves in many forms, sizes and depths, but wherever water is fast, and there are backwaters formed, try the point where the reverse and rapid waters meet, all the swirls and eddies formed on the edges, and above all never miss the 'white feather' of water formed by a boulder jutting out, or by a submerged tree, however shallow it may be. In such places feeding fish will always take up their abode. (See photograph facing chapter).

Fish the whole length of the rapid, from below for choice, as you avoid disturbing the water above while playing a fish. Do not neglect where the current slows down in the pool and fans out on either side; it is generally very good.

(3) The water above a rapid, and at the tail of a pool, if conditions are suitable, is almost the best water of all in the evening. Look

for a smooth flow of water, about 3 to 4 ft. deep over large boulders and gaining in velocity above a rapid, with a few stones dotted about out of the water, and making swirls for fish to lie; here excellent sport can usually be had with fly spoon, but remember large fish also lie up in such water.

Pools.—The head and tail of pools provide the best sport for spinning, but trolling will provide good sport if a bait is worked along a cliff face by the small bays, past out-crops of rocks, etc. Dead bait spun deep is the best for this type of fishing and will often produce the heaviest fish. If you see large fish rising in any part of the pool it is well worth trolling a dead bait over the spot while crossing from one bank to the other.

If a *Ficus* tree in fruit happens to be overhanging the bank, give the place a trial by throwing in a few berries to see if fish are interested. Any broken water in a pool is worth a trial; and, above all, a few minutes spent watching the water for movements of fish, while you have a pipe, is very often worth more than hours of flogging the water.

Lakes.—Here the expert with the fly will find his knowledge tested to the full. Small mahseer will come to bag, but the large ones are indifferent to almost any bait. I know only the Lakes of Kumaon where the methods are, to move the boat outside the willows and weeds, dropping the fly just outside in the clear water under rocks, trees, bushes etc. In general, black or white flies take the best, 'Silver Doctor', 'Zulu', 'Black Palmer', 'Walkers Claret', 'Yellow Spider', and 'Tag of Towel'.

Trolling with dead bait will also sometimes produce fish, but the largest are generally taken on paste.

In 1940 Major Corbet caught a fish over 60 pounds in the Nainital Lake, on fly, but this is very exceptional.

Canals.—In the Punjab and U.P., mahseer are to be found in some of the canals a long way down from the headworks; they are taken on spinning bait at the falls, or with paste at the various cattle drinking fords. Fish of 30 and 40 pounds have been taken at Meerut and Roorkee in the Ganges canal. The lower reaches have now been spoilt from the angler's point of view, by the grids erected across the falls for the U. P. Hydro Electric Scheme, and no fish ladders being provided.

Gram Fishing.—This form of fishing is almost exclusively practised in the C. P. rivers, where the fish prefer it to any other form of bait. Fish of 10 pounds and under are taken on light tackle, and offer excellent sport. A fly rod and light gut cast with small hooks, provides the outfit. The method of fishing is mentioned in chapter VI 'Fishing for Mahseer'. Fishing with paste is also fully described in the same chapter.

How to play a fish.—I have been frequently asked by the novice, how is he to know when to reel in while playing a fish? 'Act, Resist and Yield' as the riding master says, answers this question as well as I know. The 'Act' is casting the line, and recovering it at every possible opportunity.

'Resist' by lifting the point of your rod and applying all the pressure you can from the reel, *but through the rod.*

'Yield' to the rush of a fish, when his power outweighs yours to resist. Substitute your pony's head for the fish, your reins for your rod and line, and you yourself be the angler. Carry these aids into practice with a hooked fish, and you have the answer. It comes natural after you have been taken once or twice, the rod itself being an indicator. A fresh and lively fish will frequently pull the point down in his rush, and the tiring fish come in and allow the point of the rod to be kept up, and so ease the tension. Here again is yet another approach to explaining when to resist or yield. Get into your bones the maximum tension you can safely apply with your tackle, to a fish. When he goes beyond this, you can only adjust it by giving line, and when he comes within, you can only maintain it by winding in. An even pressure on the fish all the while, will kill in the shortest time, but do not hurry matters, as a mahseer will not give in until thoroughly tired.

General.

I will conclude this chapter with a few remarks which may be useful to those not acquainted with conditions met with in the fishing season or on a first trip.

The best season.—In Northern India, the best season is February-March-April for the large rivers, as they are most likely to be clear, and the volume of water is at its lowest. Junctions in the hills are best when one river is discoloured and the other clear, but are good at all times. The smaller rivers, that is those which are not affected by snow water, are best in October and early November; but fever, and very often roads and communications, present difficulties. Generally speaking the early hot weather is the best time. In Assam and Burma however the best bags are made in the cold weather, especially in spring-fed rivers, and at their junctions with the larger rivers.

In the rivers of Bombay, Central India, Mysore and Madras the season for mahseer fishing with spinning baits and fly is, generally speaking, from the time the rivers begin to clear after the monsoon floods, the best sport being obtained early in the season before the water has run low, after which the larger fish are mostly in the deep pools and not easily found. In some parts September-October, between the two monsoons (the S.E. and the N.E.) is also a good time: but conditions vary from year to year. All the *big* fish are taken by means of *rugi* paste, bottom fishing, and fish of over 50 lbs. are seldom taken by spinning.

Kit. Footwear. Footwear is severely tested, and although I have tried most types of boots, I am of opinion that good thick soles, with plenty of nails (both in the boots and carried spare), are the only answer to the slippery stones amongst which one is forced to wade. Rope soles may suit certain rivers, but nails suit all. Mumrogon or any other leather dressing should be applied daily, and spare boots taken. I myself carry three pairs of army boots, using them in rotation. Avoid rubber soles at all costs. In October in some rivers the rocks are not nearly so slippery as in March-April, where in places they are like bars of soap, and tosses are frequent however much care you take.

A correspondent sends me the following information regarding footwear. 'I have tried boots with hob nails (single and treble), with rope soles with coir (the same as a coir mat) soles, soles with latitudinal leather bars screwed on (just like a rugger or soccer boot), and, last but not least compressed felt soles. For both non-slip and wearing qualities, these felt soles have no equal, and I shall never wear anything else. Mine are four years old, and show very little signs of wear and will see me through many more years of the hardest fishing. I find I paid £1-13-1 (including postage). These may be obtained from Messrs. J. A. Hawkes & Sons, Ltd., 99 High Street, Poole, Dorsetshire, and are a product of the Gutta-Percha Company. I really believe that you will be doing a very real service to the fishing fraternity, by recommending the compressed felt sole, and giving it all the publicity possible'.

Clothing.—Shorts are the best and the most convenient, if your knees are hardy and can stand sun-burn.

Shirts with long sleeves or short, just whichever suits you. In Burma and Assam insects are a nuisance, and biting flies, from a quarter the size of fleas to the large green-eyed horse-fly, descend on one ravenously, and make life most unpleasant. They are not so bad in Northern India.

Jacket.—I have a sleeveless coat with plenty of pockets which button. This is handy to carry odd pair of pliers, small turn screw, penknife, small box with spare spoons, hooks, swivels, etc., and a book with casts and traces. Cigarettes carried in a shaving soap tin is a useful tip, as they keep dry and are not ruined if you wade in over the pockets or take a toss. Buttons on the pockets save losing stuff, if you should fall or get carried down stream.

Spares, such as reels, wire, hooks, weighing machine, camera and note book, can be kept in a haversack on the bank, by an orderly or attendant, or in your boat.

Medicine Chest.—Carry all necessities for fever, burns, stings, cuts, etc., dealt with in detail elsewhere. Chapter XII.

Comforts.—Cheap cigarettes and sweets are very much appreciated by camp followers and jungle folk. Woolworth trinkets, and copper pice by the women and children. Where the custom is to chew tobacco, free gifts of the dried leaf will greatly encourage willing service by baggage and camp coolies: so a sufficient supply should be carried (in a special bag, or all your possessions will be highly odorous).

(To be continued)

In the quarterly, *Angling*, now a *Country Life* publication, is a series of articles by Mr. H. Chapman Pincher, B.Sc., F.Z.S., F.R.M.S., which are expertly written, highly informative, and of the greatest interest to anglers. They are elucidated by text-figures and include Functions of the Swim-bladder in Fishes; Locomotion; Hearing; Scales and Scale-reading; Colour in Fishes; Breeding; Vision in Fishes.

Angling is a publication within the reach of all being readily obtainable for an annual subscription of 5s. 4d. post free.—*Editors*,

A REVISION OF THE INDIAN SPECIES OF *HODGSONIA* AND *TRICHOSANTHES*.

BY

B. C. KUNDU, M.A., PH.D., F.L.S.,

* *Professor of Botany, Presidency College, Calcutta.*

(With 4 plates).

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INTRODUCTION

Since the publication of Hooker's *Flora of British India* in course of the latter part of the nineteenth century, a large number of new species have been described from India by various workers and many species supposed to be non-Indian have been recorded from this country. As the descriptions of new species and new records from India are scattered in various works which are not always available to all workers on Systematic Botany, it is desirable that they should be collected together in one place. Besides, the application of the International Rules of Nomenclature necessitates a revision of the names of many plants. Thus it is felt by the workers on Systematic Botany that most of the families of the Flora of British India should be revised by competent authorities.

The idea of revising the Indian *Cucurbitaceae* was taken up by the author while he was in England and had the opportunity of working at the Kew Herbarium for some time. In the present paper the Indian species of the genera *Hodgsonia* and *Trichosanthes* have been revised. The revision of the species of other genera will follow in course of time.

India, as understood in this paper, includes India proper, Burma, Ceylon and the Andaman islands.

All the sheets in the Herbaria of the Royal Botanic Gardens, Kew, the British Museum, London, and the Royal Botanic Gardens, Sibpur, Calcutta, have been studied. The specimens referred to under each species are in the Kew Herbarium except where otherwise stated; most of such sheets are also available at the Calcutta Herbarium; a number of sheets of this Herbarium have also been referred to particularly in connection with additional localities and have been marked C. H. All the sheets of the Buitenzorg Herbarium, Java, and of the Herbarium of the Singapore Botanic Gardens placed at the disposal of the author have been examined and have proved to be of invaluable help in connection with comparative study. The specimens of the Forest Herbarium, Shillong, have also been studied.

HODGSONIA

HISTORICAL.

Hooker f. and Thomson (1853) founded the genus *Hodgsonia* on the type material of Roxburgh's *Trichosanthes heteroclita* and named it *H. heteroclita*. Blume (1825) had described a species *T. macrocarpa* amongst others, which was subsequently found to be the same as Roxburgh's *T. heteroclita*. So Cogniaux (1881) had to rename the *H. heteroclita* of Hooker f. and Thomson as *H. macrocarpa*. Ridley (1920) described a second species *H. capniocarpa* from the Malayan Peninsula. Recently the writer (1938) published an amended description of *H. capniocarpa* after comparing the available specimens of the two species.

DESCRIPTION OF THE GENUS.

Hodgsonia Hooker f. et Thomson

in Proc. Linn. Soc. II, 257-259; Hooker f. Illustrations of Himalayan plants, plates 1-3; Benth. et Hook. f. Gen. Plant., I, 821; Clarke in Hook. f. F.B.I., II, 605; Cogn. in DC. Monog., III, 348-349; King Mat. Fl. Malay Penin., No. 10, 25; Prain Beng. Pl. I, 516; Ridley Fl. Malay Penin. I, 843; Craib Fl. Siam, I, 750.

Large climbers. Stem branching, furrowed. Wood of remarkable structure. Leaves alternate, evergreen, subcoriaceous, 3-5-palmately-lobed; petiole elongate; in the axil of the leaf there is a hard conical structure of the nature of a prophyll. Tendrils 2-3-fid. Flowers large; male flowers in racemes, bracteate. Calyx tube elongate, falling after flowering; petals 5, yellow, gamopetalous, adnate to the calyx limb, segments obcuneate, spreading, apex truncate, fimbriate-lobed, lobes longitudinally twisted and pendulous, fringes of the petals 12-15 cm. long. Stamens 3, inserted within the calyx tube, syngenesious, filaments inconspicuous. Female flowers axillary, solitary. Calyx and corolla same as in the male flower; ovary unilocular, ovules 12, arranged in pairs in 3 parietal placentas; style elongate, equalling the calyx tube; stigma 3-lobed, apex of the lobes bifid. Fruits large, baccate, depressed globose, obscurely 5-furrowed. Seeds closely stuck together in pairs; the smaller one of each pair is usually abortive. Embryo exalbuminous, cotyledons large, thick and flat.

Only two species are known, both of which are Malayan, and one is reported from India.

KEY TO THE SPECIES.

Leaves glabrous on both surfaces, with conspicuous depositions of waxy substances in the areolae of the veins on the lower surface. Calyx tube 7.5-14 cm. long, dilated at the apex; calyx teeth 2.5-4 mm. long ... *H. macrocarpa*.

Veins on the lower surface of the leaves hairy, depositions of waxy substances not frequently found; calyx tube 5-6 cm. long, dilated from the middle upwards; calyx teeth very minute ... *H. capniocarpa*.

DESCRIPTION OF THE SPECIES.

H. macrocarpa Cogn. in DC. Monograph III, 349.

H. heteroclita Hook. f. and Thomson, Proc. Linn. Soc. II, 257-259; Hook. f. Illustr. Himal. Pl., Plates 1-3; Clarke in Hook. f. F.B.I. 606; Prain Beng. Pl. 516. *Trichosanthes macrocarpa* Bl. Bijdr., 935; Seringe in DC. Prodr., III, 315; Miq. Fl. Ind. Bat., I, i, 676.

T. hexasperma Bl. Bijdr., 935; Seringe loc. cit.; Miq. loc. cit., 678; *T. heteroclita* Roxb. Fl. Ind. III, 705. *T. Kadam* Miq. Fl. Ind. Bat., Suppl. I, 331.

Stem robust, 80-100 ft. long. Leaves 15-25 cm. long and about so much broad, truncate or cordate at base, glabrous on both sides with conspicuous waxy depositions in the areolae of the veins on the under surface; deeply 3-5-lobed, broadly lanceolate, acuminate. Tendrils very robust, terete, glabrous, usually bifid. Rachis of the male inflorescence thick, striated, 15-30 cm. long; pedicels short thick, bracts fleshy, oblong-lanceolate, 0.5-1 cm. long. Calyx tube yellowish, dilated at the extreme apex, 7.5-14 cm. long, 7-9 mm. broad at the apex; calyx teeth 2.5-4 mm. long. Corolla longitudinally twisted in bud, pendulous; yellow on the outside, white inside; nerves deep red, corolla lobes 3-nerved, limb about 7 cm. in diameter, fimbriate, fringes up to 15 cm. long. Fruit large, 7-12 cm. long, 15-25 cm. across, deep reddish brown, covered with very short tomentum. Seeds 5-7 cm. long, 3 cm. broad, 1-1.5 cm. thick.

East Bengal, Griffith. Chittagong, 1862 and 1863, *Hooker f. and Thomson*; Rangamatti, 1876, *J. L. Lister* (C.H.); Chittagong Hill Tracts, 1880, *Gamble*.

Sikkim, 15,000 ft., *J. D. Hooker*. Darjeeling, 2,000 ft. July, 1862, *T. Anderson* (C.H.) Aug., 1881, *Gamble*.

Assam, March, 1899, Dr. Prain's collector (C.H.); Khasia, 1,000-5,000 ft., *Hooker f. and Thomson*. Khasia and Jaintia Hills, 2,000 ft., 1878, *G. Gallatlay* (C.H.). Cachar, 1874, *Keenan*. Lushai Hills, 6,000 ft., July, 1927, *A. D. Parry*. South Lushai Hills, 3,700 ft., April, 1899, *A. T. Gage* (C.H.). Rajah Barrie, 13-4-95, *Hooker f. and Thomson*. Golaghat, 1891, Dr. King's collector (C.H.). Pobomukh, 5. 12. 11, *I. H. Burkill* (C.H.). Dibrugarh Bazar, 18. 11. 11. *I. H. Burkill* (C.H.). Sibsagar, 23 April, 1885, *C. B. Clarke* (C.H.). Dhikiajuli, April, 1902, Col. A. C. *Chatterjee* (C.H.). Sylhet, Wall. Cat. nos. 6684, 6684' B. Goyalpara, Wall. Cat. no. 6684 A.

Burma, Pegu, 3,000 ft., *S. Kurz* (C.H.). Kachin Hills (N.-E. of Burma), 1,300-2,000 ft., 28.3.97, *E. Pottinger* (C.H.). Myitkyina, 1925, Feb., 1926, *C. E. Parkinson*. Theinkun Chaun banks, South Tenasserim, Feb. 1936, *C. E. Parkinson*.

The following very interesting account is given from the Illustrations of the Himalayan Plants (*Hooker f.*, 1855).

'Very common in parts of E. Bengal. It can be found up to 5,000 ft. in the Sikkim Himalaya. It is probably a native of Java for it agrees tolerably with the descriptions of several species of *Trichosanthes* described by

Dr. Blume.¹ Stems are slender lianes, frequently 100 ft. long. The large flowers appear in May and are very deciduous; the males falling wholly away and the females breaking off just above the ovary. The great melon-like fruit called 'Kathior-pot' by the Lepchas ripens in autumn and winter. Its coarse, hard green pulp exudes a gummy fluid in great abundance, but is austere and uneatable. The embryo is white, of the texture of an almond and much esteemed, though it has very little flavour.

Some of the botanical characters of this plant are very remarkable. The flower in all respects resemble a *Trichosanthes*, but the ovary and fruit wholly differ from that genus and ally it more to the curious East African genus *Telfairia*. The placentae are decidedly marginal and the two collateral ovules, at the base of each side of the placenta, contract an adhesion, and together form only one seed with two cells, and often with two embryos, though one is frequently imperfect.'

TRICHOSANTHES.

HISTORICAL.

The genus *Trichosanthes* was first described by Linnaeus in 1737. In the first edition of the *Species Plantarum* only 4 species were described, the structural differences being mainly based on the character of the fruits. The 4 original species are *T. anguina* (China), *T. nervifolia* (India), *T. cucumerina* (India) and *T. amara* (Domingo). The first three Linnean species were later on identified with certainty, but *T. amara* is now regarded as a doubtful species.

In the second edition of the *Species Plantarum* (1763) Linnaeus added one more species, *T. punctata*, which was subsequently found to be the same as *Fevillea cordifolia* Linn.

In 1768 Burman enumerated 3 of the 4 original Linnean species from India, *T. anguina* (originally reported from China), *T. nervifolia* and *T. cucumerina* and also *T. punctata*.

In 1783 Lamarck described 7 species of *Trichosanthes* including the 4 Linnean ones. The 3 new species described by him are *T. angulata* (India), *T. corniculata* and *T. cuspidata* (India). Of these 3 species *T. corniculata* was later on identified as quite distinct from *Trichosanthes* and named by G. F. Gmelin as *Ceratosanthes tuberosa*. *T. angulata* is now regarded as a doubtful species. Neither C. B. Clarke (1876) nor Cogniaux (1881) have included this species in their respective works.

In 1790 Loureiro published his *Flora Cochinchinensis*, wherein he described 5 species from Cochinchina including 3 new ones. These are as follows:—*T. anguina* Linn., *T. cucumerina* Linn., *T. pilosa* Lour., *T. tricuspidata* Lour., and *T. scabra* Lour. Of these *T. pilosa* is now regarded as a doubtful or imperfectly known species.

In 1805, Willdenow enumerated 11 species of *Trichosanthes*. They are:—*T. anguina* Linn. (China), *T. scabra* Lour. (Cochin China), *T. nervifolia* Linn. (India), *T. cucumerina* Linn. (India), *T. tricuspidata* Lour. (Cochin China), *T. amara* Linn. (Domingo), *T. pilosa* Lour. (Cochin China) *T. caudata* Willd. (= *T. cuspidata* Lam.) (India), *T. laciniata* Klein in litt. (India) (= *T. cucumerina* Linn.), *T. tuberosa* Willd. (= *T. corniculata* Lam. = *Ceratosanthes tuberosa* Gmel.) (India), *T. foetidissima* Jacq. (Ic. Rar. III) (Guinea) (= *Kedrostis foetidissima* Cogn.).

In 1825, Blume described 13 species from Dutch East Indies including 10 new ones. The species are:—*T. anguina* Linn., *T. costata* Bl., *T. cucumerina* Linn., *T. villosa* Bl., *T. grandiflora* Bl., *T. tricuspidata* Lour., *T. hexasperma* Bl., *T. macrocarpa* Bl., *T. coriacea* Bl., *T. pubera* Bl., *T. globosa* Bl. and *T. trifoliata* Bl. All the new species of Blume are still regarded

¹ *Trichosanthes hexasperma* Bl. and *T. macrocarpa* Bl. have later on been identified with *Hodgsonia macrocarpa* Cogn.

as good species except three; *T. costata* has been identified with a species of *Gymnopetalum*, *G. cochinchinense* Kurz (1871, p. 57); both *T. hexasperma* and *T. macrocarpa* have now become *Hodgsonia macrocarpa* Cogn.

In the Index Kewensis *T. pubera* Bl. has been regarded as a synonym of *T. palmata* Roxb. and at the same time *T. bracteata* Roxb. has been mentioned as a valid species. This anomalous condition of the 3 species should be clarified. *T. pubera* was originally described by Blume from the Dutch East Indies. It has not been mentioned by Roxburgh (1834), Voigt (1848) and Clarke (1879) in their respective works. Miquel (1855) has kept it separated from *T. palmata* Roxb. as a distinct species. Cogniaux has reduced it to a variety of *T. bracteata* Voigt and gave its habit as Java. King¹ named all the sheets of *T. bracteata* in the Calcutta Herbarium as *T. pubera* and remarked on one of the sheets that the correct name of the species would be *T. pubera* Bl. and not *T. bracteata* Voigt. as Blume's name was older than that of Voigt.

The original description of *T. pubera* by Blume is as follows: 'Folia exciso cordata, tricuspidata, denticulata, subtus subtomentosa, flores feminei solitarii, pepo ovatus acutus.' These structural characteristics seem to be sufficiently distinct to regard it as a separate species. Unfortunately there is no specimen of *T. pubera* in the Herbarium of the Royal Botanic Gardens, Kew, and the British Museum, London, and also in the Calcutta Herbarium. In the Buitenzorg Herbarium there is only one sheet without fruit, identified by Cogniaux as *T. bracteata* var. *pubera*. The leaves and calyx lobes are different from those of *T. bracteata*. The present author thinks that *T. pubera* Bl. is distinct from *T. bracteata* Voigt (= *T. palmata* Roxb.). But even if the 2 species be identical the correct name would be *T. bracteata* (Lam.) Voigt and not *T. pubera* Bl. (as suggested by King), as the species was originally described by Lamarck (1796) as *Modecca bracteata*.

Seringe in the 3rd part of De candolle's Prodrômus (1828) enumerated 24 species. They included the 4 Linnean species, the 3 species of Loureiro, the 3 species of Lamarck, the 10 species of Blume, *T. laciniata* Klein (Spec. Plant. Willd., 1805), *T. colubrina* Jacq. f., *T. chinensis* Ser. and *T. tamnifolia* Poir. - *T. colubrina* Jacq. f. has since been identified with *T. anguina* Linn. (Kurz, 1877 p. 98). *T. tamnifolia* Poir is now regarded as a doubtful species. *T. chinensis* Ser. has not yet been properly identified. Cogniaux thinks it may be the same as *T. cucumeroides* Maximowicz.

Roxburgh in his Hortus Bengalensis (1814) enumerated 7 species including 5 new ones which were described for the first time in his Flora Indica (1832, pp. 701-707). The species are:— *T. anguina* Linn., *T. dioeca* Roxb., *T. cucumerina* Linn., *T. lobata* Roxb., *T. cordata* Roxb. *T. palmata* Roxb. and *T. heteroclita* Roxb. Of the new species *T. palmata* was renamed *T. bracteata* Voigt; *T. heteroclita* was transferred by Hooker f. and Thomson (1853) to the new genus *Hodgsonia* as *H. heteroclita* (= *H. macrocarpa* Cogn.)

Wight and Walker-Arnott in their Prodrômus (1834) enumerated 5 species of *Trichosanthes*: *T. nervifolia* Linn., *T. cuspidata* Lam., *T. anguina* Linn., *T. cucumerina* Linn. and *T. palmata* Roxb. They consider that the genus *Involucraria* Seringe is scarcely distinct from *Trichosanthes* and regard that *Involucraria Wallichiana* Ser. is the same as *T. palmata* Roxb. Subsequently Wight (1842) united the genus *Involucraria* with *Trichosanthes* and renamed *I. Wallichiana* as *T. Wallichiana*.

In Wight's Illustrations of Indian Botany (Vol. II, 1850) the following species of *Trichosanthes* are enumerated:—*T. cucumerina* Linn., *T. anguina* Linn., *T. Wallichiana* Wight and *T. palmata* Roxb.

All the 7 species mentioned by Roxburgh were enumerated by Voigt (1845) in his Hortus Suburbanus Calcuttensis. He found that *Modecca bracteata*

¹ Sir George King, once Superintendent of the Royal Botanic Gardens, Sibpur, Calcutta,

(Fam. *Passifloraceae*) of Lamarck (1796, p. 210) is the same as *Trichosanthes palmata* Roxb. and so renamed *T. palmata* Roxb. as *T. bracteata* retaining the original specific name. Kurz (1877), Cogniaux (1881), Gagnepain (1921) and Craib (1931) referred to this species as *T. bracteata*.

In 1855 Miquel published his Flora of Nederlandsh Indie in which he enumerated 23 species including 5 new ones. They are: the 10 species of Blume, *T. dioica* Roxb., *T. reniformis* Miq. (later on identified as *T. cucumerina* Linn.), *T. angulata* Lam., *T. cucumerina* Linn., *T. laciniosa* Klein (= *T. cucumerina* Linn.), *T. tricuspidata* Lour., *T. Horsfieldii* Miq., *T. pedatifolia* Miq. (= *T. cucumerina* Linn.), *T. anguina* Linn., *T. javanica* Miq. (= *Thladiantha cordifolia* Cogn.), *T. pilosa* Lour., *T. palmata* Roxb. (= *T. bracteata* Voigt.) and *T. tricuspis* Miq. (= *T. pubera* Bl.?).

In 1860 Miquel enumerated two more species from the Dutch East Indies, one of them being a new one: *T. coriacea* Bl. and *T. Kadam* Miq. His *T. Kadam* was later on identified as *T. heteroclita* Roxb. afterwards named *H. macrocarpa* Cogn.

During the years 1865-66 Miquel described two new species, *T. multiloba* and *T. quadricirrho* from Japan. *T. quadricirrho* was subsequently named as *T. cucumeroides* (= *Bryonia cucumeroides* Ser.) by Maximowicz (1875).

In the year 1859 Thwaites enumerated 4 species of *Trichosanthes* from Ceylon. They are: *T. cucumerina* Linn., *T. nervifolia* Linn., *T. palmata* Roxb., and a new species *T. integrifolia*. His species *T. integrifolia* was included by Clarke in Hooker's Flora of British India (Vol. II, p. 610), but subsequently this name was revised by Cogniaux. It was at first thought by Kurz (1871) that *Cucumis integrifolius* Roxb. was a species of *Gymnopetalum* and he then named it *Gymnopetalum integrifolium*. Later on he considered that his *G. integrifolium* was a species of *Trichosanthes* and renamed it *T. integrifolia* retaining the original specific name of Roxburgh. Thus there were two entirely different species bearing the same name—*T. integrifolia*, one of Kurz and another of Thwaites. So Cogniaux renamed the *T. integrifolia* of Thwaites as *T. Thwaitesii*. (Cogniaux should have renamed the *T. integrifolia* of Kurz as this name was not valid, because at the time of Kurz's publication of this species, there was already another species bearing the same name). Cogniaux and Harms (1924), however, consider *T. integrifolia* Kurz as *Gymnopetalum integrifolium* Kurz. After a careful study of the two species the present author considers that *T. integrifolia* Kurz is the same as *T. scabra* Lour. as suggested by Craib (1931). So the name *T. integrifolia* Thwaites remains valid.

Beddome in 1866 described a new species of *Trichosanthes*—*T. anamalayana*. This species was not included by Clarke in Hooker's Flora probably owing to the type specimen not being found anywhere. Cogniaux (1881), however, included it in his Monograph repeating Beddome's descriptions. Gamble (1919) has also included this species in his Flora of the Madras Presidency.

In 1871, Kurz enumerated *T. reniformis* from the Sikkim Himalayas. His *T. reniformis* could never be the *T. reniformis* of Miquel, which was subsequently identified as *T. cucumerina* Linn. In structural features it resembles *T. dicaelosperma* Clarke (1879). As there has already been a *T. reniformis* Miquel, so Kurz's name can no longer remain valid and is now regarded as a synonym of *T. dicaelosperma*. In 1872 Kurz described a further new species—*T. macrosiphon*, which was subsequently identified with *T. cordata* Roxb.

In 1877 Kurz enumerated 9 species of *Trichosanthes* from Burma including 2 new species—*T. grandibracteata* and *T. integrifolia* (now identified as *T. scabra* Lour.). His *T. grandibracteata* was later on identified as *T. multiloba* by Clarke and subsequently as *T. Wallichiana* by Cogniaux.

In Hooker's Flora of British India (Vol. II, part vi, 1879) Clarke enumerated 12 species of *Trichosanthes*, which included the 3 Linnean species, the 4 species of Roxburgh (less *T. heteroclita* being named *Hodgsonia macrocarpa*), *T. multiloba* (= *T. Wallichiana* Wight.), *T. integrifolia* Thwaites and 3 new species—*T. truncata*, *T. himalensis*, and *T. dicaelosperma*.

There appears to be some confusion regarding the occurrence of *T. multiloba* Miq. in India. The species has up to now been reported from Japan and Borneo. The plant named *T. multiloba* by Clarke has now been found to be identical with *T. Wallichiana* Wight. Kanjilal and Das (1938) report a species under that name from Assam but the characters given by them for their species are not the same as those given originally by Miquel (1855-56 and 1866-67) or in detail by Cogniaux (1881). The writer examined a sheet from the Forest Herbarium, Shillong, named as *T. multiloba* and found it to be *T. bracteata* only. He also examined the Japanese specimens of *T. multiloba* Miq. in the Kew Herbarium and found that they markedly differed from the *T. Wallichiana* Wight (*T. multiloba* Clarke) as found in India.

In 1881, Cogniaux enumerated 40 species of *Trichosanthes* including 18 from India. Out of these, 11 were new including 5 from India. They are *T. Perrottetiana*, *T. villosula*, *T. ovata*, *T. Lepiniana* and *T. Thwaitesii*; of these *T. Thwaitesii* is no longer valid and becomes *T. integrifolia* Thwaites and *T. integrifolia* Kurz is now identified with *T. scabra* Lour.

Recently the writer (1939) has described the following new species from India: *T. brevibracteata*, *T. pachyrrhachis*, *T. khasiana* and *T. majuscula*.

T. ovigera Blume originally described from Java is a new record from the Indian area.

Two new species—*T. Prazeri* Kundu and *T. burmensis* Kundu and three new varieties, *T. villosula* Cogn. var. *nilgirrensis* Kundu, *T. ovigera* Blume var. *sikkimensis* Kundu and *T. burmensis* Kundu var. *alba* Kundu have been described in this paper.

DESCRIPTION OF THE GENUS.

Trichosanthes Linn.

Gen. Pl. 295 (1737); Spec. Pl. ed. I, 1068; ed. II, 1432; Juss. Gen. Pl., 396; Burman Fl. Ind., 207; Lamarck Encycl. Methodique I, 189; Lour. Fl. Cochinch., 588; Willd. Spec. Pl. IV, 598; Blume Bijdr., 932; Ser. in DC. Prodr. III, 313; Roxb. Fl. Ind. III, 701; Wight & Arn. Prodr. I, 349; Endlicher Gen. Pl. 939; Wight in Ann. and Mag. Nat. Hist. VIII, 269; Voigt Hort. Subur. Calcutt., 57; Roem. Syn. Fasc. II, 16; Miq. Fl. Ind. Bat. I, i, 674; Naud. in Ann. Sc. Nat. ser. 4, XVIII, 188. Benth. Fl. Austral. III, 314; Benth and Hook. f. Gen. Pl. I, 821; Thwaites Enum. Pl. Zeyl., 126; Clarke in Hook. f. F. B. I. II, 606; Cogn. in DC. Monog. III, 351; Cooke Fl. Bomb. I, 525; Trim. Fl. Ceylon II, 243; King Mat. Fl. Malay Penin. no. 10, 26; Duthie Fl. Upp. Gang. Plain I, 362; Prain Beng. Pl. I, 516; Gamble Fl. Madras I, iii, 528; Haines Bot. Behar & Orissa II, 387; Ridley Fl. Malay, Penin. I, 843; Merrill Enum. Philip. Fl. Pl. III, 584; Gagnep. in F.I.C. II, 1036; Craib Fl. Siam I, 751.

Climbing herbs, annual or perennial. Leaves simple, unlobed or palmately 3-9-lobed, margin usually denticulate; rarely compound, 3-5-foliolate. Tendrils usually 2-5-fid, rarely simple. Flowers dioecious or monoecious, usually white, rarely red. Male flowers usually in racemes, rarely solitary; in some cases the male peduncles in axillary pairs, one 1-flowered, caducous, the other racemose; bracts variable in size or 0. Calyx tube elongate, cylindric, frequently dilated above; teeth 5, short or long, entire, serrate or lacinate. Petals 5, connate at the base; lobes usually long fimbriate. Stamens 3, inserted in the calyx tube; filaments very short, free, anthers connate (free in *T. dioica* Roxb.), two 2-celled, the third 1-celled, the cells conduplicate. Female flowers solitary, very rarely in racemes. Calyx and corolla as in the male. Ovary inferior, ovoid or fusiform, one-celled with 3 parietal placentas; ovules usually many, generally horizontal, half pendulous; style slender, long; stigmas 3, entire or bifid. Fruit fleshy; globose, ovoid or fusiform in shape; usually many-seeded, indehiscent, glabrous and smooth. Seeds of various types, compressed, oblong, ellipsoid or angulate; frequently marginate.

KEY TO THE SPECIES

GENUS. *TRICHOSANTHES*

SECTION I. *EUTRICHOSANTHES*—Male flowers in racemes.

- A. Seeds strongly compressed, not surrounded by ridges.
- B. Bracts minute or absent.
- C. Leaves not lobed.
 - D. Male racemes few-flowered, erect; calyx teeth very short, triangular ... 1. *nervifolia*.
 - D. Male racemes many-flowered, geniculate; calyx teeth elongate, subulate ... 2. *cuspidata*.
- C. Leaves distinctly lobed or more or less angular or slightly lobed.
 - D. Male flowers ebracteate. Leaves usually large, more or less angular or 3-5-lobed, suborbicular in outline ... 3. *cucumerina*.
 - D. Male flowers minutely bracteate.
 - E. Pedicels of male flowers shorter than the flowers.
 - F. Rachis of male raceme robust, succulent, somewhat geniculate and sometimes flowering from near the base; fruit small ovate-acute... ... 4. *pachyrrhachis*.
 - F. Rachis of male raceme erect, few-flowered at the apex (rarely geniculate and many-flowered as sometimes in *T. anguina*, in that case fruit very long and twisted).
 - G. Leaves deeply 5-7-lobed, lobes obovate or spatulate; fruits oblong-linear, 14-20 cm. long, 2-5 cm. broad, acute at both ends ... 6. *lobata*.
 - G. Leaves angular or 3-5-lobed.
 - H. Fruits very long, narrow twisted with many seeds; leaves deeply lobed, lobes of the leaves rounded, faintly denticulate ... 7. *anguina*.
 - H. Fruits small, ovate-acute, 3-6 cm. long, 2-4 cm. broad. Leaves usually small, very thin, 3-5-angled or very shortly 5-lobed, reniform in outline, apex acute, margin dentate, 3-5-5 cm. long., 4-5-6 cm. broad ... 5. *brevibracteata*.
 - E. Pedicels of male flowers long, usually longer than the flowers.
 - F. Leaves glabrous on both sides, deeply 3-lobed with distant subulate teeth; petals rather shortly fimbriate ... 8. *Perrottetiana*.
 - F. Leaves densely villose-hirsute beneath, 5-7 lobed with shallow sinuses and subulate teeth; petals long fimbriate; inflorescence and petiole more or less villous 9. *villosula*.
- B. Bracts large.
 - C. Leaves truncate or attenuate at base.
 - D. Leaves ovate-oblong; bracts petiolate, oblong-lanceolate 10. *truncata*

- D. Leaves broadly ovate, bracts sessile, ovate. 11. *ovata*.
- C. Leaves cordate at base.
 - D. Female flowers solitary, ebracteate.
 - E. Calyx segments entire.
 - F. Leaves entire (not lobed), smooth or slightly hirsute underneath, ovate-triangular; bracts absolutely entire... 12. *cordata*.
 - F. Leaves more or less lobed.
 - G. Leaves very rough, but not hairy on the upper surface; smooth or hairy at the nerves on the under surface; peduncles of the male racemes few-flowered at the apex; bracts crenate or incised ... 13. *Wallichiana*.
 - G. Leaves hairy at the nerves on the upper surface, lower surface glabrous and smooth.
 - H. Leaves very large, about 25 cm. long, deeply 5-lobed, rachis of male racemes many-flowered and flowering from near the base ... 14. *majuscula*.
 - H. Leaves smaller, 9-15 cm. long, deeply 3-lobed, or sub-5-lobed, peduncle of the male racemes few-flowered at the apex ... 15. *khassiana*.
- E. Calyx segments not entire.
 - F. Calyx segments narrow with 2-3 short subulate incisions.
 - Leaves pedately 5-6 lobed, tendrils slender, simple or bifid, flowers red, corolla lobes fimbriate ... 16. *Prazeri*.
 - F. Calyx segments broader, dentate, serrate or laciniate
 - G. Leaves glabrous on both surfaces, bracts ovate or obovate.
 - H. Calyx lobes shortly dentate or serrate, fruits globose ... 17. *bracteata*.
 - H. Calyx segments deeply divided into 3-5 subulate lobes, fruit ovoid ... 18. *Lepiniana*.
 - G. Leaves densely puberulous, particularly hairy at the veins on the under surface; upper surface glabrous; bracts cucullate, subreniform in outline.
 - H. Leaves shortly 5-lobed, flowers red ... 19. *burmensis*.
 - H. Leaves 5-lobed, divided nearly up to the middle, flowers white ... *burmensis* var. *alba*.
- D. Female flowers bracteate, usually racemose... 20. *anamalayana*.
- A. Seeds turgid, broader than long, longitudinally surrounded by one or two very thick ridges.
- B. Male racemes bracteate, bracts somewhat large, narrowed towards the base.
- C. Leaves deeply trilobed, seeds unilocular ... 21. *himalensis*.

- C. Leaves not lobed or very shortly trilobed towards the apex.
 D. Fruit ovoid, seeds trilocular, the 2 lateral loculi empty ... 22. *ovigera*.
 D. Fruit ovoid-oblong, seeds unilocular or the 2 lateral loculi represented by 2 minute pores ... *ovigera* var. *sikkimensis*.
 B. Male racemes ebracteate or with very minute or subulate bracts ... 23. *dicelosperma*.

SECTION II. *PSEUDOTRICHOSANTHES*—Male and female flowers solitary.

- A. Leaves cordate at base, margin dentate or denticulate, tendrils simple or bifid.
 B. Leaves cordate-oblong, fruit oblong ... 24. *dioica*.
 B. Leaves reniform, fruit subglobose ... 25. *scabra*.
 A. Leaves rounded at base, margin entire, tendrils simple ... 26. *integrifolia*.

DESCRIPTION OF THE SPECIES.

1. *T. nervifolia* Linn. Spec. Pl. Ed. I, 1008; Ed. 2, 1432; Burman Fl. Ind., 308; Willd. Spec. Pl. IV, 599; Ser. in DC. Prodr. III, 314; Wight & Arnott Prodr., I, 349; Thwaites Enum. Pl. Zeyl. 127; Clarke in Hook. f. F.B.I. II, 609; Cogn. in DC. Monog. III, 356; Cooke Fl. Bomb. I, 526; Trim. Fl. Ceylon II, 244; Gamble Fl. Madras I, iii, 529. *Totipira* Rheed. Hort. Malabar. VIII, 33, Plate 17.

Stem slender, elongated, grooved, glabrous. Leaves narrow, thin, not lobed, ovate-oblong, margin minutely and distantly denticulate, glabrous and smooth on both surfaces, 6-10 cm. long, 2.5-6 cm. broad; 3-nerved at the base, veins thin, prominent on the lower surface; apex acute or acuminate; petiole glabrous or slightly puberulous, 1-2 cm. long. Tendrils slender, short, terete, bifid. Male peduncles usually paired; one 1-flowered and the second one is a few flowered erect raceme which is usually shorter than the leaves, ebracteate or sub-bracteate; rachis slender, 2-7 cm. long, 2-7-flowered. Pedicels 0.5-2 cm. long. Calyx tube linear, dilated at the apex, 17-20 mm. long; teeth erect, short, triangular, 0.5-1 mm. long. Staminal filaments very short; antheridial head oblong 3 mm. long. Fruit ovoid-oblong, acute at the base and apex. Seeds half-ellipsoid, compressed with corrugated margins.

Mount Nilgiri and Kurg, Thomson. Deccan Peninsula, Quilon, Wight. Ceylon, Thwaites, Hance. Kodai Kanal Ghat, Nov., 1897, Sir A. G. and Lady Bourne. Belgaum District, Nov., 1899, W. A. Talbot (C. H.). Kavalay Cochin, 2,000 ft. Nov., 1910, A. Meebold (C.H.).

2. *T. cuspidata* Lam. Encycl. Meth. Bot., I, 188; Ser. in DC. Prodr. III, 314; Wight and Arnott Prodr. I, 349; Cogn. in DC. Monog. III, 357; *T. caudata* Willd. Spec. Pl. IV, 600; Scheru Padavalam Rheed. Hort. Malab. VIII, 31, plate 16.

Stem slender. Leaves narrow, thin, not lobed, ovate-oblong, margin minutely and remotely dentate, shortly acuminate, glabrous and smooth on both surfaces, 6-10 cm. long, 2.5-5 cm. broad, 3-nerved at the base. Tendrils slender, bifid. Male flowers in raceme, which are (10-30) many-flowered, usually geniculate, sub-bracteate, and slightly shorter than or nearly as long as the leaves; rachis slender, flowering from near the base, 4-7 cm. long. Pedicels 2-6 mm. long. Calyx tube dilated at the apex, 11-14 mm. long; teeth erect, 2-2.5 mm. long. Staminal filaments very short. Fruit (from Rheede's drawing) 5-7.5 cm. thick, circular in transverse section, about twice as long as broad, acute.

Quilon, Oct., 1835, *Wight*; Peninsulæ Indiae Orientalis, (S. India) no. 1135, Herb. *Wight* (C.H.). Travancore and Malabar, *Gamble*.

Clarke in Hooker's Flora of British India reduced *T. cuspidata* to *T. nervifolia* Linn. from which it may be separated by its many-flowered geniculate male racemes which are flowering from near the base and by the elongate and subulate calyx teeth.

3. *T. cucumerina* Linn. Spec. Pl. Ed. I, 1008; Ed. 2, 1432; Lour. Fl.

Cochinch., 588; Burman Fl. Ind., 308; Willd. Spec. Pl. IV, 600; Ser. in DC. Prodr. III, 315; Blume Bijdr., 933; Roxb. Fl. Ind. III, 702; *Wight* & Arnott Prodr. I, 350; Miq., Fl. Ind. Bat. I, i, 676; Thwaites Enum. Pl. Zeyl., 125; Kurz in Journ. As. Soc. Beng., 1877, ii, 98; Clarke in Hook. F.B.I., II, 609; Cogn. in DC. Monog. III, 357; King. Mat. Fl. Malay. Penin. no. 10, 27; Cooke Fl. Bomb. I, 527; Trum. Fl. Ceylon II, 245; Duthie Fl. Upp. Gang. Plain I, 364; Prain Beng. Pl. I, 518; Gamble Fl. Madras I, iii, 529; Haines Bot. Behar Orissa II, 388; 1241; Gagnepain in Lecomte in Fl. Indoch. II, 1040; Merrill Enum. Philup. Fl. Pl. III, 584; Craib. Fl. Siam. I, 752.

T. luciniosa Klein in Willd. Spec. Pl. IV, 601; Ser. in DC. Prodr. III, 315; Miq. Fl. Ind. Bat. I, i, 676. *T. reniformis* Miq. Fl. Ind. Bat. I, i, 675 (not of Kurz); *T. pedatifolia* Miq. loc. cit., 677. *T. cochinchinensis* Roemer Syn. Fasc. II, 96; *T. Wightiana* Roemer loc. cit. *T. olida* F. V. Muell in Trans. Soc. Bot. Edin. VI, 491. Padavalam Rheed. Hort. Malab. VIII 29, plate 15.

[*T. pilosa* Wall. Cat. no. 6691 (not of Loureiro). *Cucumis missionis* Wall. Cat. no. 6728]

Stem slender, profusely branching and densely leafy, more or less pubescent. Leaves membranous, suborbicular in outline, margin denticulate, base deeply cordate, upper surface covered with scattered hairs, lower surface shortly puberulous; 7-10 cm. long, 8-12 cm. broad, more or less deeply 5-lobed, rarely 3-7 lobed, lobes acute or rounded. Tendrils slender, elongate, puberulous, 2-3-fid. Flowers dioecious or monoecious. Male peduncles in pairs, the earlier 1-flowered, the later racemed; sometimes a female flower is found in place of the earlier male flower. Racemes few flowered; rachis slender, puberulous, 6-15 cm. long, having 6-12 flowers at the apex. Pedicels of flowers short ebracteate, erect, puberulous, 1-2 cm. long. Calyx tube somewhat dilated at the apex, 15-16 mm. long. Staminal filaments very slender, 1-1.5 mm. long; antheridial head oblong, 3 mm. long, 1.5 mm. thick. Ovary oblong. Fruit ovoid-conical, 5-7 cm. long, 3.5-4 cm. thick, with about 7-10 seeds. Seeds ovate-oblong, compressed, rugulose, margin thick with toothed projections from both the surfaces; 12 mm. long, 5-6 mm. broad, 2 mm. thick.

It is a very common species and specimens have been collected from nearly all parts of India including Ceylon and Burma and the Andamans by various botanists from very early times.

Distribution.—Java (Malaya); North Australia.

4. *T. pachyrrhachis* Kundu in Journ. Bot. lxxvii, 9.

Stem slender, deeply grooved, glabrous or slightly papillose. Leaves membranous, suborbicular or reniform, with a cordate base, densely covered with short hairs with occasional long ones on the upper surface, lower surface densely and shortly pubescent, very shortly 3-5-lobed, lobes subacute; margin denticulate or dentate; 3.5-5 cm. long, 5-6.5 cm. broad, usually 3-nerved at the base, veins slender. Petiole slender, 2-3 cm. long, striate, sparsely papillose. Tendrils somewhat robust, grooved, puberulous, 3-fid. Flowers monoecious. Male racemes 10-16-flowered; rachis robust, somewhat geniculate, sometimes nearly as thick as the stem, succulent, striate or grooved, glabrous, 7-11 cm. long, usually flowering from near the base. Pedicels terete, robust, erect, slightly puberulous, 3-6 mm. long. Calyx tube short, dilated at the apex, about 13-20 mm. long, 4 mm. broad at the apex; teeth spreading, 1 mm. long.



Trichosanthes pachyrrhachis Kundu.



Trichosanthes brevibracteata Kundu.

Petals oblong. Staminal filaments slender, very short, 1 mm. long; anther head subquadangular, 2.5-3 mm. long, 2.5 mm. broad. Female flowers not seen. Fruiting pedicel solitary, 2.5 cm. long. Fruit ovoid-ellipsoid, attenuate into an acuminate apex; epicarp thin. Seeds flattened with undulate margins, truncate at the base, bidentate at the apex, 10-11 mm. long, 7 mm. broad 2 mm. thick.

N. W. India, *M. P. Edgeworth*, 1863. Dehra Dun, Aug., 1869, 1870.

G. King N.-W. Himalaya, *P. W. Mackinnon* (C. H.).

Burma, Sept. 1902, *Shaikh Mokim* (C. H.).

N. Bengal. below Dingra Ghat and Purneah, 30-10-68, *S. Kurz*. (C. H.)

5. *T. brevibracteata* *Kundu* in Journ. Bot. lxxvii, 10.

Stem very slender, grooved, subglabrous. Leaves membranous, very thin, 3-5-angled or very shortly 5-lobed, reniform, apex acute, base cordate-emarginate, margin dentate, on the upper surface covered with minute hairs together with a few longer ones, on the lower surface pubescent; deep green on the upper surface, pale green on the lower surface; 3.5-7.5 cm. long, 4.5-9 cm. broad, 3-5 nerved at the base, veins very thin, prominent on the lower surface. Petioles slender, striate, 2-4.5 cm. long, papillose-puberulous with some long hairs. Tendrils very slender, 2-3-fid. Monoecious or (?) dioecious. Male flowers in racemes. Rachis bearing male flowers slender, striate, puberulous, 5-10.5 cm. long, 5-10-flowered at the apex. Pedicels slender, erect or spreading, puberulous, 5-15 mm. long. Calyx tubular, attenuate from the apex towards base, 14-18 mm. long, 3-4 mm. broad at the apex; teeth spreading, 1-1.5 mm. long. Petals oblong, 8-10 mm. long, 3 mm. broad. Staminal filaments slender, about 2 mm. long; anther head oblong, 2.5 mm. long, 1.25 mm. broad. Female flowers not seen. Fruiting peduncles solitary, 8-10 mm. long. Fruit ellipsoid, attenuate into a conical apex, 3.5-4.5 cm. long, 1.5-2.5 cm. thick with about 7-8 seeds. Seeds flattened, oblong, subglabrous on both surfaces, somewhat undulate at the sides, base and apex truncate, 10 mm. long, 6-6.5 mm. broad, 2 mm. thick.

Karnal, Punjab, 1855-1888, *J. R. Drummond*, 24669, 24979, 24988, 25000, 25003, 25006, 25010, 25031, 25999.

Ahmedabad, July, 1920, *L. J. Sedjwick*. N.-W. India, *Thomson* s. n. (Herb. Hook. fil. et Thoms.)

Koni, Travancore State, South India, August, 1913, *Calder and Narayana-swami*;

Canara, July, 1883, *W. A. Talbot* (C.H.)

Distribution—Java (Malaya).

var. *sublobata* *Kundu* in Journ. Bot. lxxvii, 11.

Leaves larger, shortly lobed, 7.5-10 cm. long, 9-15 cm. broad; margin denticulate; petioles robust, 2-7 cm. long; stem puberulous or somewhat villose. Tendrils 2-3-fid. Bracts although very short usually thicker than in the type and somewhat flattened.

Quilon, June, 1836, *Wight*. Cachar, June, 1874, *Keenan*, Sanghoa Jungle, Karnal, Punjab, Sept. 1887, *J. R. Drummond*. Banda, N.-W.P. Dec., 1902, *Mrs. A. S. Bell*. Nagpur-Wardha, C.P., Sept., 1912, *Haines*.

var. *longirostrata* *Kundu* in Journ. Bot. lxxvii, 11.

Stems and petioles villous. Leaves larger, 7.5-8 cm. long, 10 cm. broad; petiole 5-6 cm. long. Tendrils robust, 3-4-fid. Bracts more conspicuous than those of the type, up to 2 mm. long. Young fruit 5.5-6 cm. long, with a long beak.

Burma, 15 August, 1908, *J. H. Lace*, 6335.

6. *T. lobata* *Roxb.* Fl. Ind. III, 701; Roemer Syn. Fasc. II, 96; Kurz in Journ. As. Soc. Beng., xlvii, ii, 98; Clarke in Hooker, F.B.I., II, 610.

Stem slender, grooved, puberulous. Leaves membranous, suborbicular in outline, base broadly cordate, 5-7-lobed, slightly puberulous on both surfaces, 6-9 cm. long, hairy. Tendrils 3-5-fid, divided near about the middle. Male flowers in racemes, ebracteate or minutely bracteate; rachis slender, puberulous, 8-15 cm. long, few flowered at the apex; calyx tube slightly dilated at the apex, puberulous. Female flowers solitary, axillary. Fruit linear-oblong, 14-20 cm. long, 2-5 cm. broad, acute at both ends. Seeds compressed, thick, surface rugulose, margin irregularly tubercled, truncate both at the apex and at the base, 10 mm. long, 6 mm. broad and 2.5-3 mm. thick.

Common in Bengal. Lucknow, (1854) (C.H.). Wall. Cat. no. 6693.

This plant is called 'Ban Chichinga' in Bengali and is fairly common in hedges. It flowers during the rainy season. I have seen the typical fruits as described by Roxburgh (smooth, ornamented lengthways, except near the base with ten white streaks) looking very much like small fruits of *T. anguina* Linn. (hence the Bengali name 'Ban Chichinga').

Cogniaux has reduced this species to *T. cucumerina* Linn. and Gamble in his Madras Flora has followed him. It is a distinct species which can be distinguished from the latter by the character of the leaves and structure and size of the fruit. Prain has not mentioned this species in his Bengal Plants and has given the Bengali name Ban Chichinga to *T. cucumerina* which never bears elongated fruits like those borne by *T. lobata* Roxb.

Wight and Walker-Arnott (1834) suggested that this might be a variety of *T. cucumerina*; Clarke in the Flora of British India also thought the same. Probably this is the wild form of the cultivated *T. anguina* Linn. Haines in the Botany of Behar and Orissa has reduced *T. anguina* as a variety of *T. cucumerina*, with which *T. lobata* has been merged.

7. *T. anguina* Linn. Sp. Pl. Ed. 1, 1008; Ed. 2, 1432; Burman Fl. Ind., 207; Lam. Encycl. Meth. Bot. 1, 190; Lour. Fl. Cochinch., 588; Willd. Sp. Pl. IV, 598; Blume Bijdr. II, 933; Ser. in DC. Prodr. III, 314; Roxb. Fl. Ind. III, 701; Wight and Arnott Prodr. I, 350; Miq. Fl. Ind. Bat. I, i, 677; Kurz in Journ. As. Soc. Beng. xlvii, ii, 98; Clarke in Hooker F.B.I., II, 610; Cogn. in DC. Monog. III, 359; Cooke Fl. Bomb. I, 527; Duthie Fl. Upp. Gang. Plain I, 364; Prain Beng. Pl. I, 518; Gamble Fl. Madras, I, iii, 530; Gangnepain in Lecomte Fl. Indoch. II, 1039; Craib Fl. Siam I, 751. *T. cucumerina* Linn. var. *anguina* Haines Bot. Behar & Orissa, II, 388. *T. colubrina* Jacq. f. Eclog. plate 128; Ser. in DC. Prodr. III, 314.

Stem slender, branching, angular, puberulous. Leaves membranous, suborbicular, margin finely denticulate or undulated, base cordate or emarginate, subglabrous on the upper surface, lower surface densely puberulous and rough; 5-angular or more or less 5-lobed, lobes roundish; 7-15 cm. long, 8-18 cm. broad; veins slender, usually 3-nerved at the base. Petiole villous, 3.5-10 cm. long. Tendrils robust, grooved, puberulous, 2-3 fid. Flowers monoecious. Male raceme usually few-flowered. Rachis of the male raceme robust, striate, puberulous, 8-25 cm. long, 8-15-flowered. Pedicels slender, erect, spreading, minutely bracteate, 0.5-2 cm. long. Calyx tube subcylindrical, slightly dilated at the apex, puberulous, 2.5-3 cm. long, 4-5 mm. broad at the apex, teeth short, subulate, reflexed, 2 mm. long. Petals oblong 8-9 mm. long, 3 mm. broad. Staminal filaments slender, 2 mm. long, antheridial head ovoid, 2.5-3 mm. long, 2 mm. thick. Female flowers solitary, peduncle 0.5-5 cm. long. Ovary narrowly fusiform, more or less villous. Fruit very long, surface smooth, cylindric, sometimes contorted. Seeds oblong, finely rugulose, margins undulate, 15-20 mm. long, 6-10 mm. broad, 2.5-5.5 mm. thick.

It is a cultivated species and has never been collected in wild condition. It is allied to *T. cucumerina* Linn. and *T. lobata* Roxb., the latter seems to be its nearest relation, of which it may be regarded as a cultivated variety.

Cultivated throughout India, Burma and the Andamans for its very long and twisted polymorphous fruit which is used as a vegetable. Miquel in his 'Flora van Nederlandsch Indie' p. 677, states that the male flowers possess

large leafy sheathing bracts; in the Indian specimens, however the bracts are minute.

Distribution.—China and Malaya.

8. *T. Perrottetiana* Cogn. in DC. Monograph III, 362; Gamble Fl. Madras I, iii, 529.

Stems moderately slender, branched, angular, glabrous or slightly puberulous. Leaves subcoriaceous, ovate-suborbicular in outline, margin distantly subulate-denticulate, very deeply cordate at the base, glabrous and smooth on both sides, slightly dilated at the base, 12-14 cm. long, 10-12 cm. broad; usually nearly trilobed up to the middle, lobes oblong-triangular, acuminate, the middle lobe slightly longer; veins slender, prominent on the upper surface. Petiole slender, straight, subglabrous, 5-7 cm. long. Tendrils robust, elongated, deeply grooved, slightly puberulous, 3-fid. Male raceme many-flowered; Rachis of the male raceme moderately slender, grooved, glabrous or slightly puberulous; (10-15)-flowered; 15-20 cm. long. Pedicels very long with minute bracts at the base, slender, erect, 5-10 cm. long; bracts subulate, caducous, 3-5 mm. long. Calyx tube very shortly puberulous, subcylindrical, dilated above, the apex slightly constricted, 10-nerved, 1.5-2 cm. long, at the apex 3 mm. and at the middle 1.5 mm. broad; teeth erect, long and linear, 4-5 mm. long. Filaments of the stamens, very slender, 2 mm. long; antheridial head oblong, 4 mm. long, 2 mm. thick. Pistillodium 5-6 mm. long. Female flowers and fruit unknown.—From the description of Cogniaux.

Carnatic at Pondicherry (Perrottet, No. 256 in herb. Bois. and Vindob).

The specimen No. 13445 in the Kew Herbarium and also in the Calcutta Herbarium collected by Gamble from Sirpara Ghata, Nilgiris district, at 5000 ft. on Nov. 1883 seems to belong to this species. It agrees with the description of *T. Perrottetiana* Cogn. except in the number of flowers in the male raceme, the flowers in the male raceme in this specimen being few in number.

9. *T. villosula* Cogn. in DC. Monog. III, 362; Gamble Fl. Madras, I, iii, 529.

Stem slender, elongate, grooved, sparsely villose. Leaves 8-13 cm. long and as much broad, membranaceous, suborbicular, margin subcrenulate-denticulate, base deeply cordate, upper side shortly puberulous and somewhat rough; on the lower surface densely villose-hirsute, 5-lobed up to the middle; lobes ovate oblong, acute or shortly acuminate, occasionally lobulate. Petiole thinly covered with long weak hairs, 3-6 cm. long. Tendrils robust, elongate, 3-4-fid. Male peduncle in pairs; the earlier 1-flowered; the later racemed; racemes many flowered; rachis slender, sparsely villose, (10-20)-flowered, 10-16 cm. long; pedicels very long, erect-spreading 2-5 cm. long, minutely bracteate at the base; bracts caducous 1-2 mm. long. Calyx tube subcylindric, dilated above, constricted at the apex, 2-2.5 cm. long, 2 mm. broad in the middle, 5 mm. broad at the apex; calyx teeth spreading, 5-7 mm. long. Petals oblong-lanceolate, tri-nerved, acuminate, 12-13 mm. long, 3-4 mm. broad, fimbriate, 1-1.5 mm. long. Female flowers solitary, axillary. Fruiting peduncle 1.5 cm. long; fruit ovoid, acuminate, 5.5-6 cm. long, 2-5 cm. broad in the middle.

Mount Nilgiri, 5,000 ft., June 1883, August, 1884 Gamble. Coonoor, Sept. 1886. Gamble; Herbarium of Sir A. G. and Lady Bourne in Kew. Upper Pulneys, 6,500 ft., 22-9-1911. C. E. C. Fischer (C.H.) Coimbatore, 5,400 ft., 13-12-1907, C. E. C. Fischer (C.H.).

var. *nilgirensis* var. nov.

A typo sequentibus signis: caulis puberulus, folia 5-7-lobata vel sub-9-lobata, lobati ad medium lobi oblongi vel spathulati, margo leviter denticulatus, apex obtusa vel acuta, supra glabris vel valde minime puberula ad nervos, infra leviter puberula cum sparsis setis, petiolus leviter puberulus differt.

Distinguished from the type in having the following characters:—Stem puberulous, leaves 5-7-lobed or sub-9-lobed, lobed up to the middle, lobes oblong or spatulate, margin shortly denticulate, apex acute or obtuse, upper surface glabrous or very slightly puberulous at the veins, lower surface slightly puberulous with occasional long ones; petiole slightly puberulous.

Coonoor, Nilgiris, 6,000 ft., Nov. 1884, no. 15733, J. S. Gamble (Type in the Calcutta Herbarium).

10. *T. truncata* Clarke in Hooker f. F.B.I., II, 608; Cogn. in DC. Monog. III, 364.

Stem robust, elongate, angular-striate, glabrous, punctate. Leaves coriaceous, entire or rarely irregularly tricuspidate, ovate-oblong; apex acuminate, base round, margin usually entire or rarely distantly and minutely denticulate, glabrous on both sides, 13-16 cm. long, 6-8 cm. broad, 3-nerved rarely 5-nerved at base, veins slender, prominent on the lower surface. Petiole robust, grooved, glabrous, punctate, 4-6 cm. long. Tendrils very slender, elongate, terete, subglabrous, 2-3-fid. Male raceme 8-20-flowered; rachis stout, striate, flowering at the apex, 7-15 cm. long; pedicels very slender, puberulous, 1-3 mm. long; bracts ovate, shortly petiolate, apex acuminate, margin entire or more usually with a few teeth. Calyx tube shortly tomentose, dilated above, 2-3 cm. long; teeth spreading, linear, 5-7 mm. long, 1-1.5 mm. broad at the base. Corolla shortly tomentose on the outside. Female flowers solitary, axillary. Fruiting peduncle short, 8 mm. long. Fruit oblong, 10 cm. long, 3-4 cm. broad; epicarp tough. Seeds smooth, oblong-obovate, base truncate, apex obtuse, 21 mm. long, 12 mm. broad, 3 mm. thick.

Khasia Mts., 4,000 ft. *Hook. f. Thomson; Clarke; Sadiya N.-E. Assam. G. K. Deka* (Forest Herbarium, Shillong). Sikkim, 1,000 ft. *Hooker f.; 1,200 ft. Aug., 1873, Gamble. Darjeeling, 1,500 ft., March, 1871, C. B. Clarke; 1,800 ft., Gamble.*

11. *T. ovata* Cogn. in DC. Monog. III, 365.

Stem slightly robust, elongate, branched, angular-striate, smooth or puberulous, thinly punctate. Leaves membranous, entire, broadly ovate, apex shortly acuminate, base round or truncate, margin minutely distantly denticulate; glabrous on both sides; 14-18 cm. long, 11-14 cm. broad; base trinerved, nerves somewhat slender and thinly reticulate, on the lower surface slightly prominent. Tendrils 2-3-fid, slender, very elongate, terete, glabrous. Male raceme sub-capitate, few-flowered; rachis very robust, striate, glabrous, 6-10-flowered at the apex, 10-15 cm. long; pedicels very slender, shortly villose, 1-2 cm. long; bracts sessile, ovate, acute, round at the base, margin entire or somewhat undulate, trinerved, 12-15 mm. long, 8-10 mm. broad. Calyx tube short, tomentose, dilated above; teeth spreading or reflexed, linear, 7-9 mm. long, 1.5 mm. broad. Corolla very shortly tomentose. Female flowers and fruit unknown.—Descriptions from the monograph of Cogniaux.

Sikkim, *Thomson* in Herb. Hort. Petrop. and Lugduno-Batavia.

12. *T. cordata* Roxb in Fl. Ind. III, 703; Kurz in Journ. As. Soc. Beng. XLVI, ii, 99; Clarke in Hook. f. F.B.I. II, 608; Cogn. in DC. Monog. III, 367; Duthie in Fl. Upp. Gang. Pl. I, 363. *T. macrosiphon* Kurz in Journ. As. Soc. Beng. XLI, ii, 308.

Roots tuberous. Stem robust, very long, angulate, grooved, glabrous or sparsely puberulous. Leaves membranous, entire (unlobed) or rarely angular-sublobate, broadly ovate-cordate, apex acute or shortly acuminate, margin minutely denticulate or crenulate-dentate, scatteredly shortly villose-hirsute on both sides, 9-20 cm. long, 9-16 cm. broad, 3-5-nerved at the base. Petiole stout, striate, sparsely puberulous, 3.5-10 cm. long. Tendrils robust, elongate, grooved, puberulous, 2-3-fid. Male raceme few-flowered; rachis stout, striate, sparsely puberulous, 12-35 cm. long, 6-12 flowered. Pedicels thick very short, 1-2 mm. long; bracts oblong, acuminate, entire, shortly villose-hirsute, 3.5-4 cm. long, 1-1.5 cm. broad. Calyx tube attenuate from the apex towards

base, densely villous, 5 cm. long, 7 mm. broad at the apex, teeth erect, flexuose, 1.5 cm. long, 2-5 mm. broad at the base. Staminal filaments very short, scarcely 1 mm. long; antheridial head 1.4 mm. long, 3-4 mm. thick. Female flower solitary; peduncle about 1 cm. long. Ovary oblong, slightly puberulous. Fruiting peduncle robust, 1-2 cm. long. Fruit globose, smooth, red. Seeds subquadrangular, 10-12 mm. long, 4-5 mm. broad, 2-2.5 mm. thick.

India, *Wallich*. Wall. Cat. no. 6686 A., 6688 C. & F. (partly). East Bengal *Griffith*; Dacca, Sept., 1868, *Clarke*; Rungpore, Bengal, Dec. 1875, *Clarke*.

Chodamvaram, Madras, 7-8-14, *M. S. Ramaswami* (C.H.); Malabar forest, 9-5-1895, *Herb. G. Watt*. (C.H.)

Dehradun, July 1882, *Duthie* (C.H.), *G. King*. (C.H.). Hardwar, *King* (ex *Duthie*).

Darjeeling 500 ft. 12 July, 1870 *Clarke* (C.H.); Sikkim, *Kurz*. Khasia, 0-4,000 ft., June, 1850, *Hooker f.* and *Thomson*; Khasia and Jaintia Hills, 6-6-39, *R.N.De* (Forest Herbarium, Shillong) no. 19203.

Naga Hills, Oct., 1885, *Clarke*; July 1886, *D. Prain* (C.H.) Upper Assam, 1841, *Jenkins*; Gauhati, Aug., 1847, *Griffith*; Nazira, Assam, 23 April, 1885 (No. 37998C, C.H.)

Cachar, *Keenan*; Kistopore, Cachar, May, 1868, *Clarke*; Lakhimpore, 25 Aug., 1909, *I. H. Burkill* (C.H.) The Andaman islands (Ex. *Kurz*). Martaban, Burma, *Kurz* (C. H.); Pegu, *Kurz* (C.H.)

var, *subpedata*. *Clarke* in *Hook. f. F.B.I.*, II, 608.

Leaves pedately lobed almost to the base. The bracts and indumentum are exactly as in the type. —

Lackpore, Cachar, May, 1868, *Clarke*.

13. ***T. Wallichiana*** *Wight*. in *Ann. and Mag. Nat. Hist.*, VIII, 270; *Cogn.* in *DC. Monog.* III, 368; *King. Mat. Fl. Malay Penin.* no. 10, 29; *Ridley Fl. Mal. Penin.* I, 845; *Gagnepain in Lecomte Fl. Indoch.* II, 1048; *Craib Fl. Siam.* I, 754. *Involucraria Wallichiana* *Seringe* in *Mem. sur la fam. des Cucurbitaceae*, plate 5; and in *DC. Prodr.* III, 318. *T. grandibracteata* *Kurz* in *Journ. As. Soc. Beng.* LXVI, 98-99. *T. multiloba* *Clarke* in *Hook. f. F.B.I.* II, 607 (not of *Miquel*).

Stem robust, angulate-grooved, glabrous. Leaves sub-coriaceous, suborbicular in outline; on the upper surface glandular punctate and very rough, on the under surface glabrous or slightly hairy at the nerves; 8-20 cm. long, 7.5-21.5 cm. broad; usually 3-nerved at base; deeply (nearly up to the base) palmately 3-9-lobed, lobes oblong, elliptical or lanceolate, acute or acuminate, denticulate or irregularly crenate-dentate. Tendrils robust, elongate, grooved, puberulous, 2-3 fid. Male raceme few—(6-12)-flowered at the apex; rachis stout, grooved, puberulous, 15-30 cm. long. Bracts broadly ovate, crenulate-subulate, slightly puberulous, multinerved, 2.5-3 cm. long. Calyx tube slightly puberulous, 5-5.5 cm. long, 12-14 mm. broad at the apex; teeth spreading, 10-15 mm. long, 5-6 mm. broad at the base. Female flowers solitary axillary; ovary ovoid-oblong, glabrous. Fruiting peduncle 2-4 cm. long. Fruit ovoid or oblong-ellipsoid, not globose, with an acute or subacute apex, 5-10 cm. long, 4-8.5 cm. thick. Seeds truncate at base, much swollen in the middle, surface smooth, 15-18 mm. long, 7-12 mm. broad, 6-9 mm. thick; cotyledons thick and oily.

N.-W. India, *Royle*. Kumaon, June, 1845, *Thomson*. Simla, 1880, *Collett*. Bombay, *W. H. Talbot*.

Sikkim, 2,000-6,000 ft., *Griffith*; *Hooker f.*, *Hooker f. and Thomson*; *G. King* (C.H.); Phadonchen, 7,000 ft., 20-8-10, *W. W. Smith* (C.H.); Mungpoo, 18-7-14, *Indrayni Nepali* (C.H.); Tumloong, 5,500 ft. 10-7-92, *G. A. Gammie* (C.H.); Darjeeling 4,000-7,000 ft. Aug., 1874 & 1876, July, 1881, *Gamble*; Oct., 1870, Aug., 1875, *Clarke*; Sikkim Terai, *S. Kurz* (C.H.). Khasia, 2,000-5,000 ft., *Hooker f. & Thomson*; Aug. & Oct., 1885, *Clarke* rough;

June, 1876, *S. Kurz*. Shillong, June, 1911, *R. K. Das* (C.H.); Dunpep, May, 1911, *R. K. Das* (C.H.). Lawlyngdoh, Khasia and Jaintia Hills 28-6-38, *S. P. Sharma* (Forest Herbarium, Shillong, no. 16682). Thakabanea Pfutsero, Naga Hills, 7,000 ft., June & July, 1935. *N. L. Bor*; Pastelling, 6,500 ft., 1904, *Haines*; Tingala Bum Jungle, Assam March, 1899, Dr. Prain's Collector.

Kachin Hills, Upper Burma, Jan., 1898, *Shaikh Mokim* (C.H.); Mynela (Yunan Expedition), *D. J. Anderson* (C.H.); Pahang, *H.N.R.*

Distribution.—Malaya Peninsula.

14. *T. majuscula* Kundu in Journ. Bot. lxxvii, 12.

T. Wallichiana Wight. var. *majuscula* Clarke, Cogn. in DC. Monog. III, 369; *T. multiloba* Miq. var. *majuscula* Clarke in Hook. F.B.I. II, 608.

Stem very stout, elongate; grooved, glabrous. Leaves very large, membranous, glabrous and smooth on the lower surface, smooth but slightly hairy at the nerves on the upper surface, deeply palmately 5-lobed, lobes elliptic-obovate, cuspidate, narrow towards the base, up to 8 cm. broad in the middle, sinus between lobes obtuse, margin irregularly crenulate, deep green on the upper surface, pale green on the lower surface, 23 cm. long, 22-25 cm. broad, 3-nerved at the base. Petiole very robust, striate, covered with very short hairs, 6-6.5 cm. long. Tendrils very robust and woody, grooved, very slightly hairy, branched above at a distance of 11 cm. from base, 3-fid, the middle branch much more prominent and much longer than the lateral ones. Male flowers in racemes; rachis very stout and woody, 30 cm. long, (25-30) many-flowered, very much grooved and puberulous; peduncle 9.5 cm. long. Bracts oblong, finely serrate, multinerved, 3.5-4.5 cm. long. Pedicels very short, thick and woody. Calyx tube about 6 cm. long, 1 cm. broad at the apex, attenuate from the apex towards the base; teeth elongate, triangular-lanceolate, spreading, papillose, margins entire, 1 cm. long, 5 mm. broad at the base. Female flowers and fruit unknown.

Khasia mountains, Assam, 4,000 ft. *Hook. f. & Thomson*, no. 7.

15. *T. khasiana* Kundu in Journ. Bot. lxxvii, 11.

Stem robust, elongate, angulate, grooved, glabrous. Leaves membranous, ovate-suborbicular in outline, slightly hairy at the nerves on the upper surface, glabrous on the lower surface, deeply palmately 3-lobed near to the base, sometimes with an additional short lobe on the side of each of the lateral ones, lobes oblong-lanceolate, apex acuminate, margin distantly denticulate, deep green on the upper surface, paler on the lower surface, 9-15 cm. long, 8-13 cm. broad, truncate or cordate at the 3-nerved base, veins slender. Petiole robust, striate, punctate or glabrous, 2.5-5 cm. long. Male raceme loosely few-flowered at the apex; rachis very robust, sometimes stouter than the stem, grooved, glabrous, puberulous in the younger regions, 9-15 cm. long. Bracts glabrous, ovate, subentire or crenulate, multinerved, 2-4.5 cm. long. Calyx tube attenuate from the apex towards base, puberulous, 4.5-5 cm. long, 8.5-10 mm. broad at the apex. teeth erect-spreading, triangular-lanceolate, 8-10 mm. long, 5-6 mm. broad at the base. Peduncle of the female flower 1.5-2.5 cm. long. Calyx tube cylindrical; teeth spreading, subulate-dentate. 6-8 mm. long, 1.5-2 mm. broad at the base. Ovary fusiform, glabrous. Fruit oblong-ellipsoid, subacute at both ends, 11-12.5 cm. long, 3.5-5 cm. thick. Seeds irregularly shaped, somewhat ovate-oblong, smooth on both sides, 10-14 mm. long, 5-8 mm. broad, 2 mm. thick. Cotyledons thin.

Khasia mountains, 2,000-6,000 ft. *Hooker and Thomson* no. 11.

16. *T. Prazeri* sp. nov.

Caulis gracilis striatus punctatus. Folia membranacea tenua ambitu sub-orbicularia, pedato-5-6-lobata, lobi spathulati vel oblongi, margo irregularis serratus vel denticulatus, apex obtusa vel obtuso-apiculata, superficies leviter puberulis ad nervos principales, subtus glabris vel glandulo-punctatus; cirrhj



Trichosanthes majuscula Kundu.



Trichosanthes khasiana Kundu.

gracilis simplex vel bifidis glabris. Racemis masculis 7-10 floris, flores colore rubro, intus rosei. Bractei magni oblong-ovati, glabres, profunde serrati, cum apice obtusa, 2.5 cent. longus, 1.7 cent. latus in medio. Calycis tuba ad basim attenuata et ad apicem dilatata, dentibus lanceolato-linearibus suintegres vel saepius cum 2-3 brevibus incisionibus, 5-6 mm. longi, 1.5-2 mm. lati in medio. Corolla fere ad basim divisa, lobata ovata-oblonga, breviter lacerata. Flores feminei et fructus ignoti.

Stem slender, grooved, punctate. Leaves membranous, thin, suborbicular in outline, lobed nearly up to base, 5-6-lobed, lobes oblong or spatulate, margin irregularly serrate or denticulate, apex obtuse or obtuse-apiculate; upper surface very slightly hairy at the main veins, lower surface glabrous or glandular punctate. Petiole slender, punctate, 2-2.5 cm. long. Tendril slender, simple or bifid, glabrous. Male flowers in racemes, rachis moderately stout, grooved, glabrous, 9-15 cm. long, 7-10-flowered; male peduncles occasionally in pairs, one early 1-flowered and the other racemed. Flowers coloured red, inside light pink. Bracts large, oblong-ovate, glabrous, margin deeply serrate, apex obtuse, 2.5 cm. long, 1.7 cm. broad in the middle. Calyx tube 4-5 cm. long, 6-7 mm. broad at the apex, narrow towards base and dilated above, glabrous; teeth narrow, lanceolate-linear, subentire or more frequently with 2-3 short subulate incisions, 5-6 mm. long, 1.5-2 mm. broad in the middle. Corolla divided nearly up to the base; lobes ovate-oblong, shortly lacerate. Female flowers and fruit unknown.

Khoni, Upper Burma, May, 1888, *J. C. Prazer* (Type in the Calcutta Herbarium).

The species is named after Mr. J. C. Prazer, the collector of the plant.

A slender plant—from its very look appears to be quite distinct and different from other species of the group. It is related to *T. bracteata* Voigt and *T. Lepiniana* Cogn. The thin leaves of the plant are quite characteristic and could be easily separated from the thick, rough and subcoriaceous leaves of its two near relations. Although in *T. bracteata* Voigt the leaves are very variable but nothing like the thin spatulate-lobed leaves of this plant could be found there. The calyx teeth of the flower of this plant are narrow and have 2-3 short subulate incisions. They are also much smaller than and different from those of *T. bracteata* and *T. Lepiniana*. Corolla lobes are not fimbriate but shortly lacerate. Besides the above characteristics the colour of the flower as reported by the collector is very interesting.

It is also related to *T. longiflora* Cogn., a species from New Guinea. From that species it is distinguished in having oblong or spatulate lobes of the leaves, large oblong-obovate deeply serrate bracts and in the red colour of the flowers and in the structure of the calyx tube.

17. ***T. bracteata*** (Lam.) Voigt Hortus Suburbanus Calcuttensis, 58; Kurz in Journ. As. Soc. Beng. xvi, ii, 99; Cogn. in DC. Monog. III, 375; Merrill Enum. Philip. Fl. Pl., III, 584; Gagnepain in Lecomte Fl. Indoch. II, 1041; Craib. Fl. Siam I, 751.

Modecca bracteata Lam. Encycl. Meth. Bot. IV, 210; DC. Prodr. III, 337.

T. palmata Roxb. Fl. Ind. III, 704; Wight and Arnott Prodr. I, 350; Wight Illustr. pls. 104, 105; Miq. Fl. Ind. Bat. I, i, 628; Thwaites Enum. Pl. Zeyl. 127; Kurz Report Veget. And. Isl. p. ix; Clarke in Hook. f. F.B.I. II, 606; King Mat. Fl. Malay Penin. no. 10, p. 29; Trim Fl. Ceylon II, 244; Cooke Fl. Bomb. I, 526; Duthie Fl. Upp. Gang. Plain I, 363; Prain Beng. Pl. I, 318; Gamble Fl. Madras I, iii, 529; Haines Bot. Behar Orissa II, 387; Ridley Fl. Mal Penin, I, 845.

Stem stout, puberulous and rough. Leaves membranous or sub-coriaceous, suborbicular in outline, rough and glandular punctate on the upper surface, glabrous and smooth on the under surface; veins on the under surface have small punctate glands; subentire or frequently deeply palmately 3-7-lobed, lobes ovate-oblong, very variable in size, margin entire, dentate, serrate or somewhat lobulate; apex usually acute. Petiole 2.5-9 cm. long. Tendrils

robust, 3-fid. Male flowers in racemes; rachis stout, 8-20 cm. long, few-(5-10)-flowered. Bracts ovate or obovate, deeply incised, many-nerved, 3-4 cm. long. Calyx tube attenuate from the apex towards the base, shortly villose, 4-5 cm. long, at the apex 10-12 mm. broad; teeth erect, spreading, elongate, triangular-lanceolate, dentate or serrate, sometimes subpinnatifid, 12-15 mm. long, 3-4 mm. broad at the base. Staminal filaments 1-2 mm. long. Female flowers axillary, solitary (according to Roxburgh sometimes racemed). Fruit globose, bright red with 10 orange streaks. Seeds numerous, immersed in green pulp, ovate oblong, smooth on both surfaces, 10-12 mm. long, 6 mm. broad in the middle, 2 mm. thick.

Specimens have been collected from all parts of India from the Himalayas to Ceylon, Burma and the Andamans; very common and ascending up to 5,000 ft.

Distribution.—Malaya, China, Japan and North Australia.

var. *scotanthus* Clarke in Hook. f. F.B.I. II, 607.

Leaves palmately lobed; lobed more than half-way down, nearly up to the base; Upper surface somewhat scabrid, lower surface glabrous. Tendrils bifid. Male raceme 9-10 cm. long, 5-6-flowered at the apex. Bracts 1.5 cm. long, 1 cm. broad in the middle. Calyx teeth broad, lanceolate, nearly entire. Petals nearly destitute of fimbriations (jagged), ('especially in the female'—Clarke).

Punkabari, Darjeeling, 500 ft. 4th Sept., 1870, C. B. Clarke (C.H.)

There is only one sheet with male flowers only in the Calcutta Herbarium, which seems to be the type. There is no sheet in the Kew Herbarium. This looks very much like a distinct species, but cannot be established as the specimens are not quite sufficient to raise it to the standard of a species.

var. *tomentosa* Heyne in Herb. Rottler: Clarke in Hook. f. F.B.I. II, 607; Cogn. in DC. Monog. III, 377; Gamble Fl. Madras I, iii, 530.

Leaves much less lobed, divided not more than half way down, scarcely scabrous, tomentose beneath. Bracts and calyx lobes more deeply lacinate.

Western Ghats, in the Mysore Hills; Pulneys and Nilgiris at about 3,000-6,000 ft. Ceylon, 1847 *Gardner*.

This, too, seems to be a distinct species; C. B. Clarke also thought like that and remarked, 'This looks like a good species, but the fruit and seeds are as in var. 1. This closely resembles the Australian *T. subvelutina* Muell. in Herb. referred to *T. palmata* by Bentham.' It, however, differs from *T. subvelutina* Muell. subsequently described by Cogniaux in having the calyx lobes deeply lacinate. Until and unless more specimens are collected, the plant is kept as a variety of *T. bracteata* Voigt.

18. *T. Lepiniana* Cogn. in DC. Monog. III, 377; Gamble Fl. Madras I, iii, 530; Gagnepain in Lecomte Fl. Indoch. II, 1042; Craib Fl. Siam. I., 753; *Involucaria Lepiniana* Naud. in Huber. Cat., II (1868).

Stem robust, glabrous and smooth. Leaves membranous, suborbicular in outline, on both surfaces glabrous and smooth or finely punctate or rough; shortly palmately 3-5-lobed, lobes broadly ovate or triangular, acute or shortly acuminate, margin distantly subulate-dentate, 3-5 nerved at the base, 10-20 cm. long and as much broad. Petioles robust, 4-6 cm. long. Tendrils 3-4-fid, glabrous. Flowers dioecious; male flowers in racemes; rachis stout, smooth, 15-20 cm. long, 5-10 flowered at the apex; bracts obovate, 2-3 cm. long with subulate incisions, multinerved; pedicels very short, 2-5 mm. long. Calyx tube shortly puberulous, 5-6 cm. long, attenuate from the apex towards the base; teeth spreading, elongate, deeply 3-5-lobed, 14-16 mm. long, 5 mm. broad. Petals obovate, 2-3 cm. long, deeply lacinate, with long fringes. Female flowers solitary, peduncle 2-4 cm. long. Ovary oblong, glabrous.

Fruit ovoid, smooth, red. Seeds black, obscurely marginate, 13-15 mm. long, 6-7 mm. broad, 2.5 mm. thick.

Carnatic at Pondicherry, *Lepine*; Mt. Nilgiris and Kurg, no. 14 *Thomson*; Sikkim, 1-5,000 ft. *Hooker f.*; Kolbong, Sikkim, S. *Kurz* (C.H.). Madras, *Hooker f.* and *Thomson*. Assam, Naga Hills, 4,800 ft.; Nchaumrai Naga Hills, 5,000 ft., May 1935, N. L. *Bor*

Distribution—Cambodia.

19. *T. burmensis* sp. nov.

Caulis elongatus, sulcatus, parum puberulus. Folia membranacea, ovato-suborbicularia, supra punctata, leviter puberula ad nervos principales, subtus densissime puberula, maxime pilosa ad nervos, breviter 5-lobata, serrata vel denticulata, apex loborum acuta vel breviter acuminata, 11-15 cent. longa, aequa lata, basis levita cordata, nervei subtus conspicui, 4-5 nervei ad basim *Cirrhis robusticulus*, 3-fidis. Racemes masculi robusti, sulcati, leviter puberuli. 12-25 cent. longi, 4-6 florati ad apicem. Bractei magni, cucullati, subreniformes, multinerviati, lacerati, apex rotunda, 3 cent. longi, 5 cent. lati, puberuli. Flores rubri, calycis tuba gradatim ad apicem dilatata, 4 cent. longa, 6-7 mm. lata ad apicem, lobi subcucullati, ovato-triangulares, apex loborum acuminata, lacininata, latiores in medio, fere tenuis ad basim et gradatim convergens ad apicem 2-2.2 cent. longi, 1 cent. lati in medio. Corolla divisa fere ad basim, rubri colore, petala profunde lacininata. Flores feminei solitarii, axillares Fructus ovoid-oblongi cum epicarpo firmo, 11 cent. longi, 6 cent. lati. Semina multa, oblonga, 9-10 mm. longa, 4-5 mm. lata, 1.5 mm. crassa.

Stem elongate, grooved, slightly puberulous. Leaves membranous, ovate-suborbicular in outline, upper surface punctate dotted, slightly hairy at the main veins, lower surface densely puberulous, particularly hairy at the veins, shortly 5-lobed, margin serrate or denticulate, apex of lobes acute or shortly acuminate, 11-15 cm. long and as much broad, base slightly cordate, veins prominent on the lower surface, 4-5-nerved at base. Petiole slender, striate, slightly puberulous, punctate, 7-8.5 cm. long. Tendrils moderately stout, 3-fid. Rachis of male raceme stout, grooved, slightly puberulous, 12-25 cm. long, 4-6-flowered at the apex. Bracts large, cucullate (not flat), subreniform in outline, multinerved, margin lacerate, apex rounded, 3 cm. long, 5 cm. broad, puberulous. Flowers red. Calyx tube gradually dilated towards apex, 4 cm. long, 6-7 mm. broad at the apex, lobes somewhat cucullate, ovate-triangular in outline, apex of lobes acuminate, margin laciniate, broader in the middle, somewhat narrow towards base and gradually tapering towards apex, 2-2.2 cm. long, 1 cm. broad in the middle. Corolla divided nearly up to the base, colour red. Female flowers solitary, axillary. Fruit ovoid-oblong with a tough epicarp, 11 cm. long, 6 cm. broad. Seeds many oblong, 9-10 mm. long, 4-5 mm. broad, 1.5 mm. thick.

Upper Burma, Southern Shan State, 1893, *Abdul Khalil* (Type in the Calcutta Herbarium); Pegu, S. *Kurz*. no. 1062 (C.H.).

The species is quite distinct and can be separated from other species of *Trichosanthes* in having the following distinguishing features:—Leaves shortly lobed and densely puberulous on the lower surface, particularly hairy at the veins, cucullate and subreniform bracts; deeply laciniate calyx lobes and the red colour of the flowers. From *T. bracteata* Voigt and *T. Lepiniana* Cogn. it is distinguished by the characteristic of its leaves and bracts and by the colour of the flowers. From *T. rubriflos* Thorel ex Cayla in which the stem, petiole, tendril, bracts and flowers are red it is easily separated by the nature of its leaves, bracts and calyx lobes. From *T. Prazeri* where the flowers are also red, it is sharply distinguished by the structure of its leaves, tendrils, bracts calyx and corolla lobes.

var. *alba* var. nov.

Differt a typo sequentibus signis: folia 5-lobata, divisa fere ad medium suborbicularia, lobi oblonga vel ovato-oblonga, apex acuta, margo serrato-denticulatus, flores albi.

Separated from the type in having the following distinguishing features: leaves 5-lobed, divided nearly up to the middle, suborbicular in outline, lobes oblong or ovate-oblong, apex acute, margin serrate-denticulate; flowers white.

Maymyo, Upper Burma, July, 1888, *Badal Khan* (Dr. King's Collector) no. 130 (Type in the Calcutta Herbarium).

20. *T. anamelayana* *Bedd.* in *Trans. Linn. Soc.* xxv, 217; *Cogn.* in *DC. Monog.* III, 378, *Gamble Fl. Madras*, I, iii, 530.

Tendrils 2-3-fid. Leaves 3-5-lobed; on the upper surface very scabrous, on the under surface pubescent; irregularly deeply serrate; 10-12.5 cm. long and as much broad. Flowers white, males in racemes with the calyx larger and more lacinate than in the female flower; staminal filaments 3, rarely 4, free, inserted in the gibbous part of the tube, anthers coherent; corolla very hirsute within; female flowers axillary, solitary or 2 together with a lanceolate bract or more often racemose and subtended by large lacinate bracts. Berry globose.

Anamallay Mountains, up to 4,000 ft.

Although it is not very well known, it seems to be very extraordinary on account of the female flowers being borne in racemes. Unfortunately *Beddome* did not preserve any specimen and up till now no specimen of this remarkable species has been collected. The description given above is from *Beddome's*.

21. *T. himalensis* *Clarke* in *Hooker F.B.I.* II, 608; *Cogn.* in *DC. Monog.* III, 379; *Duthie Fl. Upp. Gang. Plain*, I, 363. *Gagnepain* in *Lecomte Fl. Indoch.* II, 1038.

Stem slender, extensively climbing. Leaves slightly rough on the upper surface, shortly villose and rough on the under surface; deeply palmately 3-lobed or sub-5-lobed, lobes shortly acuminate, margins irregularly serrate. Petiole shortly villose or subhirsute, 3-6 cm. long. Tendrils stout, 2-3-fid. Male flowers in racemes; rachis slender, 2-8 cm. long, 4-10 flowered at the apex. Bracts 5-14 mm. long, lanceolate, with serrate incisions and narrow base, 2-4 mm. broad in the middle. Calyx tube narrow, cylindrical, slightly dilated at the apex, 2.5 cm. long, 3 mm. broad the apex and 1 mm. broad in the middle; teeth linear, subulate, 6-7 mm. long. (Female flowers not seen). Fruit 7.5-10 cm. long, 2.5-3 cm. thick, attenuate at both ends, nearly circular in cross section. Seeds 6-7 mm. long 7-9 mm. broad, 4-5 mm. thick, very turgid, polymorphous.

India, *Wallich*, *Wall. Cat.* no. 6686 B. Sikkim, Darjeeling, Aug. 1869, Sept., 1875, *Hooker f.*; Oct. 1875, *Clarke*; 4,000 ft., Sept., 1881, *Gamble* (C.H.); Sikkim, 2,500 ft., 3-9-75, *King* (C.H.); Pankabari, 1,000 ft. Aug., 1875, *Gamble* (C.H.); Kalimpong, 4-5,000 ft., Sept., 1914, *Thomson Ripley* (C.H.). Khasia Hills, Aug. 1880 no. 9. *Hooker f.* and *Thomson*; 22-11-32, *S. R. Sharma* (Forest Herbarium Shillong). Jotsoma, Naga Hills, 5,000 ft. Aug., 1935, *N. L. Bor.* Chittagong, 0-1,000 ft. 1851, *Hooker f.* and *Thomson*. Khari Dist. in *N. Oudh* (*ex Duthie*).

- var. *glabrior* *Clarke* in *Hooker F.B.I.* II, 608; *Cogn.* in *DC. Monog.* III, 379.

Leaves glabrous or somewhat hirsute at the nerves on the under surface. Khasia, 4,000 ft., *Hooker f.* and *Thomson*.

22. *T. ovigera* *Blume* *Bijdr.*, 934; *Ser.* in *DC. Prodr.* III, 314; *Roemer Syn. Fasc.* II, 95; *Miq. Fl. Ind. Bat.* I, i, 674; *Cogn.* in *DC. Monog.* III, 380. *T. Hearnii* *King*, in *Mat. Fl. Malay Penin.* no. 10; p. 28.

Stem slender, grooved, glabrous; Leaves membranous, broadly ovate, apex acute or acuminate, base deeply cordate, margin distantly denticulate or dentate; unlobed or sometimes remotely shortly lobed; under surface glabrous, lower surface minutely pubescent; 3-nerved at the base; 10-16 cm. long, 9-15 cm. broad. Petiole 2.5-5 cm. long, shortly villose. Tendril puberulous, slender, 2-fid.

Male flowers in axillary racemes; sometimes the racemes are found in pairs; occasionally the two racemes are borne on a common peduncle. Bracts linear oblong, entire, 5-8 mm. long, 2 mm. broad in the middle, acute at both ends, pubescent. Calyx tube subcylindrical, puberulous, somewhat dilated at the mouth, 3-3.5 cm. long, 3-4 mm. broad at the mouth; teeth narrow, acute. Female flowers solitary, axillary. Fruit ovoid, 4-5 cm. long. Seeds broader than long, subquadrangular, longitudinally surrounded by 2 thick ridges, surface somewhat rough, apex truncate; 8 mm. long, 8-9 mm. broad, 5 mm. thick near the middle; trilocular with the 2 lateral loculi empty. (Description of female flowers and fruit from the Javanese specimens.)

Andamans, 4-10-90, King's collector (C.H.); Kurz (Ex. King).

The specimens referred to here were collected at first by Kurz and then by King's collector from the Andaman Islands. They consist of male inflorescences without any female flower or fruit. The specimens were sent to C. B. Clarke who thought that they might be *T. Hearnii* and so these were doubtfully described as *T. Hearnii* by King in his Materials for the Flora of the Malayan Peninsula.

I have had the opportunity of examining the sheets of *T. ovigera* Blume from the Buitenzorg Herbarium. After comparing the sheets in the Calcutta Herbarium bearing the name *T. Hearnii* (?) with the Javanese specimens of *T. ovigera*, I find that the former agree with *T. ovigera* Blume in practically all the details. So I refer these specimens to *T. ovigera* Blume.

T. Hearnii was named by Baron von Muller in Herbarium; an imperfect description of this species was first given by Benth in his Australian Flora (Vol. III, p. 314). Female flowers and fruits were never collected ever since. If fruits and particularly seeds had been collected I believe this species would have been found to be the same as *T. ovigera* Blume.

var. **sikkimensis** var. nov.

Folia integra vel breviter triloba ad apicem, margines denticulati, supra glabra vel sparsopuberula, infra pubescens, 8.5-15 cent. longa, 6.5-16.5 cent. lata. Rachis masculis racemis gracilis, 4-6 floribus ad apicem; bractei breviter lanceolati, breviter denticulati, apex acuminata, 7-10 cent. longa, 2 cent. lata ad medium, glabris. Flores feminei solitarii axillares. Fructus ovoido-oblongus, acutus utrisque extremis, 9-10 cent. longus, 3-5 cent. latus ad medium. Semina subquadrangularia, circumdata duobus zonis. Unilocularia vel duobus lateralibus loculis representibus duobus minutis poris.

Leaves unlobed or very shortly trilobed towards the apex, margin denticulate; upper surface glabrous or very shortly puberulous, lower surface pubescent, 8.5-16 cm. long, 6.5-16.5 cm. broad. Rachis of male raceme slender, 3-5 cm. long, 4-6 flowered at the apex. Bracts shortly lanceolate, shortly dentate, apex acuminate, 7-10 mm. long, 2 mm. broad near about the middle, glabrous. Female flowers solitary. Fruit ovoid oblong, acute at both ends, 9-10 cm. long, 3-5 cm. broad in the middle. Seeds subquadrangular, longitudinally surrounded by two thick ridges, unilocular or with the two lateral loculi represented by 2 minute pores.

Distinguished from the type in having the leaves very slightly puberulous on the upper surface and in the structure of the fruit and seeds.

Rungtung, Sikkim, Dec., 1876, A.B. (King's Collector); Sikkim, 5,000 ft., 23-9-75, G. King.; Runjeet, Darjeeling, Sept., 1884, Clarke; Selim, Sikkim, 1,000 ft. Oct., 1884, Clarke (Type); Kurseong.

Kobo, Abor Expedition, Assam no. 37420, Dec., 1911, I. H. Burkill.

(All the sheets in the Calcutta Herbarium).

23. *T. dicaelosperma* Clarke in Hooker F.B.I. II, 609; Cogn. in DC. Monog. III, 381; Duthie Fl. Upp. Gang. Plain, I, 364; *T. reiniformis* Kurz in Journ. As. Soc. Beng. xl, part ii, 57 and in Flora, 1871, 294 (not of Miquel).

Stem slender, puberulous. Leaves membranous, cordate-ovate, apex acute or shortly acuminate, margin sparsely minutely denticulate, shortly pubescent on both sides, 10-15 cm. long, 6-11 cm. broad; petiole shortly villose, 3-8 cm. long. Tendrils 2-fid. Flowers dioecious. Male peduncles paired, one early 1-flowered, the other 2-7 cm. long, racemed; 7-10-flowered at the apex; flowers ebracteate or very minutely bracteate. Calyx-tube narrow, dilated at the extreme apex, 2-2.5 cm. long, at the apex 3-4 mm. broad and in the middle only 1 mm. broad; teeth very short, spreading. Female flower axillary, solitary; peduncle subfiliform, 2-3 cm. long. Ovary oblong. Fruit pubescent, globose with 10 pale vertical bands, 3-5 cm. thick. Seeds slightly rugulose, compressed subquadrangular, 3-chambered, the two lateral ones are empty, 7-8 mm. long, 8-9 mm. broad, 3 mm. thick.

Sikkim, 2,000-5,000 ft. *Hooker f.*, *Hooker f.* and *Thomson*; 1,800 ft., Sept., 1875, *King*; *Kurz* (C.H.)

Darjeeling, 3,000 ft. Aug., 1881. *Gamble (ex Duthie)*.

Khasia Mts., 4,000 ft., *Hooker f.* and *Thomson*.

24. *T. dioica* *Roxb.* in *Fl. Ind.* III, 701; *Miq.* *Fl. Ind. Bat.* I., i, 675; *Clarke* in *Hook. f. F.B.I.* II, 609; *Cogn.* in *DC. Monog.* III, 385; *Duthie Fl. Upp. Gang. Plain I.*, 364; *Prain Beng. Pl. I.*, 517; *Haines Bot. Behar and Orissa II.*, 388.

Stem slender, shortly villose and scabrous; leaves cordate, ovate-oblong, apex acute, margin sinuate-dentate but not angled or lobed, pale green and rough on both surfaces, 7-10 cm. long, 4-8 cm. broad. Petiole 1-3 cm. long, shortly villose hirsute. Tendrils slender, simple or more frequently 2-fid from near the base. Male peduncles paired, both of them 1-flowered, the first one is up to 7 cm. long, the other one is usually short. Calyx tube dilated at the apex, 2-5 cm. long, 4-6 mm. broad at the apex, and 1-2 mm. broad in the middle; teeth erect, linear, 4-5 mm. long. Petals oblong, fimbriate. Stamens 3, free, filaments very short. Female flowers solitary; peduncles 2-4 mm. long. Fruit oblong, glabrous and smooth. 5-12 cm. long, 2-6 cm. broad. Seeds subglobose, 6-7 cm. long, 5-6 cm. broad, and 4 mm. thick.

Throughout the plains of North India from the Punjab to Assam and Bengal; also from Coromandel. (Mace in herb. Mus. Paris); common in the area.

It is extensively cultivated for the unripe fruits and young shoots which are much eaten both by Europeans and Indians in their curries and are reckoned exceedingly wholesome. The plants are perennials and for cultivation root cuttings are mainly used. The fruits when ripe are of a deep orange colour.

25. *T. scabra* *Lour.* *Fl. Cochinch.*, 589; ed. *Willd.* 723; *Seringe* in *DC. Prodr.* III, 314; *Roemer Syn. Fasc.* II, 97. *Gagnepain* in *Lecomte Fl. Indoch.* II, 1047 *Cucumis integrifolius* *Roxb.* *Fl. Ind.* III, *Gymnopetalum integrifolium* *Kurz* in *Journ. As. Soc. Beng.*, xli, ii, 58; *Clarke* in *Hooker f. F.B.I.* II, 612; *Cogn.* and *Harms* in *Englers Pflanzenreich—Cucurbitaceae—Cucumerineae*, 179. *T. integrifolia* *Kurz* in *Journ. As. Soc. Beng.* xlvii, ii, 99; *Cogn.* in *DC. Monog.* III, 386; *Craib. Fl. Siam.* I, 752.

Stem grooved, scabrid. Leaves subentire, suborbicular or more or less reniform in outline, apex obtuse, margin denticulate or undulate; upper surface very rough, provided with punctate glands, lower surface villose-hirsute, 2.5-6 cm. long, 4-9 cm. broad, 3-nerved at base; petiole 1.5 to 5 cm., sometimes up to 7 cm. long, villose-hirsute, rough. Tendrils simple or 2-fid (in *Roxburgh's* drawing). Monoecious; male and female flowers solitary, axillary, ebracteate; peduncle of the male flower 3-5 cm. long; calyx tube elongate, dilated at the apex, hairy, 19-20 cm. long in the open flower, 5 mm. broad at the apex, teeth lanceolate, 7 mm. long, 1.5 mm. broad. Petals obovate, lobes entire or lacerate. Female flowers—peduncle short; calyx teeth cylindrical, not much dilated at the apex, corolla lobes fimbriate. Fruit orange-

red (from Roxburgh), subglobose, small, smooth, 3-3.5 cm. long, 2.5-3 cm. broad. Seeds many with smooth surface, 7 mm. long, 3-4 mm. broad, 1 mm. thick.

Bengal, *Roxburgh*, Wall. Cat. no. 6730.

Burma, *Wallich*; *Griffith*; Herbarium of the East India Company, no. 2541; Pegu, Irrawady and Sittang Valley, no. 1875.

S. *Kurz* (C.H.); Banks of the Sittang, S. *Kurz* (C.H.).

Distribution—Indo-China, Malay Peninsula.

There has been some difference of opinion regarding the systematic position of this plant. It has been discussed in the Historical Account. Craib (1931) remarks in connection with this species, 'Dr. Kerr notes in the field that the corolla lobes are fimbriate. As this has been confirmed for other collections the plant has been enumerated as *Trichosanthes*.' In the male flowers on the sheet no. 1875 collected by Kurz from Pegu, Irrawady and Sittang valley, I do not see any fringe in the petals. But in the female flowers on Wall. Cat. no. 6730 the petals are distinctly fimbriate. I, therefore place the plant under *Trichosanthes*.

26. *T. integrifolia* *Thwaites* Enum. Pl. Zeyl., 127; Clarke in Hook. f. F.B.I. II, 610 Trim. Fl. Ceylon, II, 245, pl. xlii.

T. Thwaitesii Cogn. in DC. Monog. III, 387.

Stem slender, angular, grooved, glabrous. Leaves oblong or ovate-oblong, apex acuminate, base round, margin entire, glabrous and smooth but finely punctate on both surfaces, 3-nerved at the base, 8-13 cm. long, 3-6 cm. broad, petiole slender, glabrous, about 1 cm. long. Tendrils slender, long, simple. Male and female flowers both rather large, solitary, axillary; pedicel 2-2.5 cm. long. Fruits red, spherical, shortly apiculate, 5 cm. thick. Seeds numerous, crowded, blackish green, smooth, oblong, oblique, truncate at the base, bidentate at the apex, 12-14 mm. long; each enclosed in an envelope of deep green pulp.

There are no specimens in the Kew Herbarium or in the Calcutta Herbarium. There is only one young female flower on the specimen of the Herbarium of the British Museum, so the complete description of the flower could not be given. C. B. Clarke who has not seen any specimen and has given the description of the species from Thwaites's, mentions that the flowers are somewhat large and solitary. Cogniaux who has given the description from the specimens of the British Museum and the herbarium of the Paris Museum, also has not seen flowers. Trimen has only mentioned that the male and female flowers are rather large and solitary and axillary, but has not given any description of the floral parts.

Endemic in Ceylon.

Ceylon, 2,000-4,000 ft., no. 1629 *Thwaites* in the Herbarium of the British Museum.

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SUMMARY.

In this paper a general historical account of the Indian species of the genera *Hodgsonia* and *Trichosanthes* has been given. One species of *Hodgsonia* and altogether 26 species of *Trichosanthes* (excluding varieties) have been described from the Indian area, and the general distribution of these species in this country and outside has been given. Two new species—*T. Prazeri* and *T. burmensis*, and three new varieties *T. villosula* Cogn. var. *nirgirrensis*, *T. ovigera* Bl., var. *sikkimensis* and *T. burmensis* Kundu var. *alba* have been described. *T. ovigera* Bl. originally described by Blume from Java has been recorded for the first time from the Indian area.

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EXPLANATION OF THE PLATES.

- 1.—*Trichosanthes pachyrrhachis* Kundu. The type material from N.-W. India.
- 2.—*Trichosanthes brevibracteata* Kundu. The type material from Jhinjhari jungle, Karnal, Punjab.
- 3.—*Trichosanthes majuscula* Kundu. The type from the Khasia Mountains.
- 4.—*Trichosanthes khasiana* Kundu. The type from the Khasia Mountains.



NOTES ON SOME INDIAN BIRDS.

BY

E. H. N. LOWTHER, M.B.O.U., F.Z.S.

VII.—HORNBILL.

(With 8 plates from photographs by the author).

(Continued from page 795 of Vol. XLII, No. 4).

The *New Fauna* recognises sixteen species of hornbills as occurring within Indian limits, including Burma and Ceylon. This is one more than the number described in Blanford's *Fauna*. The addition is not due to a new species having been discovered but because the Indo-Burmese pied hornbill of the *Old Fauna*, *Anthracoceros albirostris*, is now separated into two races, *Hydrocissa malabarica malabarica* Gmelin., the large Indian pied hornbill, and *H. m. leucogaster* Blyth, the Burmese pied hornbill. Only two of the total will be dealt with here in any detail, for the simple reason that I have no knowledge in the field of more than this number. The two species referred to are the northern (or common) grey hornbill, *Tockus birostris* (Scopoli) and the Malabar pied hornbill (*H. malabarica*). Both are widely distributed, the *New Fauna* stating that the common grey hornbill is to be met with 'from the base of the Himalayas throughout the better-wooded parts of the Indian Peninsula, except on the Malabar and Travancore Coasts; it does not occur in Sind, the Punjab and the greater part of Rajputana, but has been found on Mount Abu; it extends to Western Bengal and Bihar, but not to Eastern Bengal or Assam.'

Actually the grey hornbill has an even wider distribution as I have seen it near Ambala, and Dewar quotes several instances of the bird nesting at Lahore and elsewhere in the Punjab. In addition, Whistler records the species as being absent from the northern and western Punjab, from which we may, perhaps, be justified in inferring that the grey hornbill occurs more or less regularly, even if uncommonly, in the southern and eastern parts of that province. The Malabar pied hornbill, we are told, is to be found in

'Ceylon, Travancore, Bombay Presidency, Ratnagiri, Orissa, Bihar, and Central Provinces . . . It also occurs in Chota Nagpore and Western Bengal.'

Chota Nagpore is one of the divisions of Bihar and its mention in this manner shows once again that the author of the *New Fauna* was at times hazy as to geography. As in the case of the grey hornbill, the Malabar pied hornbill occurs more widely than the official account would have us believe—it is certainly met with in the south-eastern corner of the United Provinces where the Allahabad district borders on Rewa State, and in the southern area of the Mirzapur district, whence a skin was recently sent me with the intimation that the bird is not uncommon in suitable parts of the *sillah*.

The common grey hornbill is about two feet in length, and as its name implies, mostly grey in colour. The crown is dark grey, almost brown, with light grey bordering, most noticeable at close quarters. The wings too are brownish, as is the tail, which is long and graduated and tipped with white, with a dark brown sub-terminal band. The under parts are light grey, becoming almost white on the abdomen, the thighs, and under the tail. The bill and casque are blackish. This species differs from the majority of others of the *genus* in that it occurs not in deep forest but in open plains country, in *topes* and avenues, and even in well-timbered compounds and round about villages. Indeed, as I remarked elsewhere¹, I found a grey hornbill's nest in a tree in Hume's old garden at Etawah, and knew of another in a hole of a *nim* tree in the very centre of a considerable *busti* in the Cawnpore district, a cavity which I was informed by the residents had been occupied by the birds for breeding purposes for several years.

The Malabar pied hornbill is a big bird—quite three feet in length. The head, neck, back, and wings, are black; so too are the two central tail feathers. The black is everywhere glossed with green. The remainder of the plumage is a pure white including the tips of the primaries and secondaries. There is a bare yellowish patch on the chin, and in the female a bare white ring round the eye. The bill is a waxy yellow, as is the base of the casque for one-third of its length. The remainder of the casque, which has a total length of eight inches, is black. Unlike the other larger representatives of the Family, this pied hornbill is not a denizen of deep, moist, ever-green jungles, but of deciduous forest, in hilly country. In many parts of Chota Nagpur it is by no means uncommon. There, during the winter months, when in camp in a suitable district, one can be almost sure of meeting with at least one party of Malabar pied hornbills every day. They may be feeding on a *banyan* or *pipal* tree, or we may be privileged to see them fly, one after the other, from one tree to another; and a beautiful picture the bird presents in its pied plumage as it makes its winged way with alternate flappings and glidings. The parties consist of from six to a dozen individuals and are most in evidence during the early morning and again in the evening.

As a family hornbills possess several peculiarities. All have eyelashes, an unusual feature in a bird's make-up. Most of them have the soft feathers absent under the wings, which makes their flight noisy. They nearly all have a casque or 'helmet'. In the larger species this is huge—I have already said that that of the Malabar pied hornbill is eight inches in length. What the use is of the casque is still a matter of conjecture; it is certainly not for the purpose of cracking nuts, as has been suggested, because there is nothing in the casque in which a nut could be cracked. Examination of a hornbill's head, however, shows that the casque is very light in weight; that only the outside is horn, the interior parts consisting of numerous fine bone-like sections with an even larger number of open cells in between. One obtains the impression that

¹ *Journal*, vol. XL, 409.



MALABAR PIED HORNBILL (female)

Hydrcissa malabarica malabarica.



the casque is a shock-absorber, though what shock it can take off the brain is not so clear. Hornbills do not chisel out holes in trees for nesting purposes; therefore there is no shock from such an operation for the casque to take up. Whether hornbills habitually prise open the hard stones of the fruit they eat, and if they do, whether this is done by holding the stone at the tip of the mandibles and cracking it, or by employing the heavy beak as a pickaxe, to break it, I am not competent to say. If the latter, then the necessity for a shock-absorber at once becomes apparent. My own observations, made from a female grey hornbill's *faeces* under a nest cavity, go to show that the stone of the *jamun* fruit is regularly thrown out unopened. These stones did not appear to have been voided. I never saw an opened stone. Hornbills, however, are most particular about cleaning their bills after they have fed the female inside the nest-hole. This they do by banging and scraping the bill against the side of a branch, repeatedly, and in what appears an unnecessarily rough manner. This banging might, in my view, cause injury to the brain but for the presence of the casque. But it is with regard to their nesting arrangements that hornbills differ from all other birds, thereby proving beyond all doubt that they are 'queer customers'. Speaking in general terms, the female hornbill, when the time comes for her to nest, enters a natural cavity in the trunk or a large branch of some tree, and there, without any further attempt at nest construction, proceeds to lay her egg or eggs. Her first egg laid, or even earlier, she sets about enclosing herself in the chamber by applying her droppings to the sides of the entrance hole until only a narrow vertical slit is left, through which the male feeds his wife regularly and devotedly until sometime after the young have hatched, whereafter she breaks down the side walls, these in the meanwhile having become so very hard that no natural enemy such as a monkey or cat can have access to her inside. During her self-imposed incarceration the female hornbill undergoes a moult of at least her wing and tail feathers, and is said to be in plump and excellent condition when she lets herself out, while the great effort of feeding first his mate and then his offspring over a period of weeks, reduces the male hornbill to a skeleton, to a shadow of his former self. After she has re-gained her liberty the female joins with her husband in feeding the young.

Here we might with advantage examine more critically the general statements made in the preceding paragraph. First, when does the female enter the nest-hole, and once she has commenced to lay, does she leave the nest before the eggs have hatched?

As with so many other questions which at once occur, there is not a great deal of evidence forthcoming, to settle the issue. Stuart Baker, writing of the Indian great hornbill, states that, as a rule, once the first egg is laid, the female does not make her exit until the young are well advanced. But, he adds, sometimes she continues to come out until the full clutch is laid. (The full clutch is one or two, and very rarely as many as three, but great irregularity occurs in laying). Dewar observes that the female common grey hornbill enters the nest before the eggs are laid and then leaves one to infer that she does not vacate it until after the

young have made their appearance. Horne (one of Hume's correspondents), writing of the same species, says of a female which he kept under observation that after she entered the nest-cavity on 29th April she did not leave it till 7th May, when he opened out the hole to take the eggs. My observations, made at three different nests of *T. birostris*, show that once the female enters the nest she does not leave it until after the eggs have hatched.

Weighing the evidence it may be that there is some variation regarding the matter among the different species.

Next, we ask ourselves, is it the female that encloses herself? or is this the work of the male? Or are both sexes responsible for the locking in of the female?

The *Old Fauna* states that the female, usually with the aid of the male, encloses herself, but adds that in some cases, e.g. *T. birostris*, the process of enclosure is performed by the female. Horne tells us he 'observed the female (common grey hornbill) working hard at enclosing the orifice with her own ordure'. Stuart Baker, describing the nesting habits of the Indian great hornbill, observes that the work of filling up the entrance is performed by the female, assisted sometimes, but not always by the male bird; and of the Assam brown-backed hornbill the same authority states that the work of plastering up the entrance hole is carried out principally by the female though at odd times the male adds a little to the plaster. Writing of hornbills generally, Whistler remarks that the female is believed to build up the plastering herself. Elsewhere, describing the nidification of the common grey hornbill, he states that the female spends the first two or three days in the nest-cavity in plastering up the entrance to the hole. Salim Ali tells us that the female grey hornbill imprisons herself. He adds that it is doubtful if the male assists her at all in this work. Writing of the same species, Dewar remarks that both the male and female work at enclosing the latter. I can only speak from personal knowledge of the common grey hornbill. In all three instances that came under my observation it was the female, and the female alone, who enclosed herself in the nest-cavity.

Here again, opinions or statements differ, but in the case of the common grey hornbill the bulk of the evidence indicates that the female alone is responsible for incarcerating herself.

What is the material employed for building in the female hornbill?

The *Old Fauna*, speaking generally of hornbills, says that the material employed is earth mixed with the bird's own droppings, but that in some cases, as with the common grey hornbill, the droppings alone are used. Horne watched a female of the same species enclose herself with her own ordure. Stuart Baker, referring to the nidification of the Indian great hornbill, observes that the droppings of the female are used, the seeds of fruit, and rotten wood, etc., which adhere to the droppings, being mixed with these. He adds that the male sometimes brings fresh clay-mud and his own droppings, though he considered this exceptional. Bingham, writing of *D. bicornis*, said that the material used for plastering up the nest-entrance was earth, leaf mould, and the bird's own droppings. Prater, discussing in *litt.* the wall from a nest of the same species sent to the



Common Grey Hornbill (male) feeding his wife. 'holding on to the bark by his claws' *vide* C. Horne in Hume's "Nests and Eggs of Indian Birds".



Malabar Pied Hornbill (female, white ring round the eye) at the nest hole.

Society, states 'it appeared to be made from chippings of bark, dung and some resinous matter.' Whistler, speaking in general terms, states that the material used is apparently the female's excrement, but in writing of the common grey hornbill says it is the female's own ordure, which is what Salim Ali also states is the case, though he qualifies this by saying that it is uncertain whether any material besides the female's excreta is used, and if this is so, how it is conveyed to the site. Dewar, describing the nest-construction of *T. birostris*, remarks that horse droppings, grass and the droppings of the birds themselves are used. Finally, there is the chemical analysis undertaken many decades since at Hume's instigation, of the plastering removed from the entrance to a nest-cavity of the rufous-necked hornbill. This showed that it consisted of nothing but the bird's own ordure, there being no evidence of the presence of clay or mineral matter of any kind.

From a distance of only ten feet I have watched from a *machan* a female common grey hornbill applying material to the entrance walls of her nest. At the time I was convinced that this was the bird's droppings. Now, however, I am not so certain. In every instance the material employed was brought from the floor of the nest and in appearance was similar to the excreta thrown out below the nest. The beak was used as a trowel when applying the stuff to the entrance walls, much laying of the plaster taking place before the bird was satisfied with her handiwork. This done she spent some time cleaning her beak thoroughly, judging by the manner in which she banged and scraped it against the interior of the chamber. I now understand it is not possible to distinguish in the plastering between a hornbill's 'cast' and the bird's dung unless a proper chemical examination is made. This being the case, the possibility cannot at present be ruled out that what I took to be droppings were in fact 'casts'. Some plastering which I recently removed from the entrance to the nest of a *T. birostris* and which I have forwarded to the Society for chemical analysis should help to elucidate this point¹. In the event of this showing that the plaster was formed from 'casts' further research will not improbably indicate that the binding agent is the female's saliva. Here it will not be out of place to mention that only twice during many days vigil at a hornbill's nest have I known the female place her vent against the nest-entrance in order to defecate outside direct. At all other times the dung was brought from the floor of the nest, held at the tip of the bill, and then thrown out.

In what form is food supplied by the male hornbill to his imprisoned wife? Writing of the small pied hornbill, Bingham, who watched the process, states that the male fed the female by 'putting single berries one after another into the tip of her bill which was shoved out of the slit; after receipt of each berry she withdrew her beak, apparently to swallow the food'. It will be observed that mention is not made of where the food lodged with the male prior to his parting with it—did he arrive with a number of berries held in his bill, visible to the naked eye? or were they stowed away in

¹ See page 401.

the crop, to be brought up one at a time? Horne, who watched a common grey hornbill feed his mate in the nest, observed much the same thing and is equally helpful in the matter of the stowing of the food prior to it being given to the female. R. Thompson (another of Hume's correspondents), who saw numbers of nests of *D. bicornis*, tells us that he often saw the male come with his throat full of berries to feed the female. Whistler, describing the nesting habits of *T. birostris*, observes that the male brings the food held in his beak. Salim Ali, unexpectedly, begs the question by being content to remark that the male common grey hornbill takes his mate 'banyan and pipal figs varied occasionally by a lizard or some other tit-bit'. Humayun Abdulali, who watched a Malabar grey hornbill feeding the imprisoned female, tells us this was done by regurgitating berries, a slow and apparently somewhat difficult process. On another occasion the same bird brought a dragon fly. This was held in the beak but owing to the bird taking fright was not made over to the female. On the male being shot about twenty-five berries of *Ixora* sp. were found in the gullet, ten more having spilled out as the bird fell. In the stomach were the remains and seeds of forty more berries. Humayun Abdulali goes on to say that 'there was no trace of any covering to form packets of seeds, as has been suggested by other observers', and quotes Br. Navarro as stating that the male when taking food 'taps at the entrance and awaits patiently the female's consent to be fed. Considerable waits are involved, but the tapping continues'.

I have spent many hours at a number of nests watching the common grey hornbill feed his mate. In not one single instance was food, intended for the female, visible in the beak; not even when this took the form of a bloodsucker lizard (*girgit*) or a dove's egg. Always the food was brought up from the gullet, one fig or berry at a time, which, held at the tip of the bill, was made over to the female whose bill-point protruded through the narrow vertical slit to receive the food. As she received the fig or berry (or other tit-bit) she invariably gave a squeal of delight and withdrew her beak into the nest-hole. Having delivered one berry, the male threw his head back and then forward, the beak open the while, this action (except in rare instances) producing another berry which was caught and held at the tip of the bill and delivered in the same way as before to his wife, who never, in my experience, delayed in at once taking whatever was passed over to her. I have seen as many as twenty-four pipal figs and a crumpled up green leaf made over in this manner to the female at one 'sitting'. Another *T. birostris* gave his wife twenty-two nim berries during one visit to the nest. The diet is sometimes varied with meat and I remember this same bird (I photographed him at the nest during four successive years) bringing up from his crop a young nestling, very pot-bellied, which was received with loud acclamation by his Other Half. Another day he twice gave her a bloodsucker lizard, and during a locust plague presented her with seven locusts, all brought up, one after the other, from the gullet. Many of their feet, and in some cases the wings, were missing. This male grey hornbill was a bird of parts and once, after an absence of nearly three hours



The 'Olive Branch'.



The next berry is coming up.



The berry reaches the tip of the bill.



More usually the male fed his wife in this manner.

THE COMMON GREY HORNBILL



The male throws his head back, then forward, the beak open the while, this action (except in rare instances) producing another berry.

from the nest, what time the female frequently gave tongue, suddenly produced a small twig from his maw—the *olive branch*, as a friend has suggested it was. He had nothing else to give his wife this visit, but even this was gladly accepted. Yet another common grey hornbill that I watched very recently at the nest (10-5-1942) first brought up from his internal economy a feather, which the female apparently had some difficulty in taking over as he had to present it five times before it was finally disposed of; then he threw his head back, and again forward. This he repeated three times before he was able to regurgitate anything. It turned out to be a slim green pod, about three inches long, and looked like some species of bean. Two more such beans were given on the occasion of this visit. In each instance the bird experienced difficulty in 'delivering the goods'. When making over the last of these to his spouse, her beak and the bean did not make proper contact, with the result that the bean fell down. The male, however, recovered it before it reached the ground only fifteen feet below—a remarkably agile performance on his part. On another occasion this grey hornbill gave his wife two *large* figs and, finally, what I took to be a tamarind pod. Again he had difficulty in bringing these up. At this nest too the female tendered her thanks by uttering a short, happy squeal each time she received something from her husband.

During a fourteen-hour watch which I and my *shikari* kept over a common grey hornbill's nest one day the male fed his wife on twelve occasions. There were then small young in the nest. Between 5 a.m. and 9 a.m. he fed her approximately every hour. Thereafter, till mid-day, he visited the nest but twice. Followed an absence for two hours; then he fed the female at 3-15, 4-25, 5-15 and 6-5 p.m.

At this point it may be of advantage to return to the subject of 'casts' and 'seeds in packets'. A cast, as the term is generally understood, is a ball or pellet of bones, fruit-stones and other such matter which a bird has failed to defecate, and which it has voided *via* the beak. I can find no reference to Indian hornbill casts in the literature at my disposal. I have also never come across a hornbill's cast in a nest, nor seen one on the ground amongst the birds' droppings, in spite of constant search; nor has anybody whom I have consulted in the matter. Why then, it may well be asked, am I so insistent on discussing the matter of hornbill casts? The answer is because I have stated I am not now certain that the material employed in walling up the entrance to a common grey hornbill's nest, or for that matter the nest of any others of the Family, may not, on chemical analysis, in part at least, prove to be composed of material cast by the bird or birds. This possibility I have put forward on the evidence recorded by Moreau on the breeding habits of African hornbills. He reports that in the case of a pair of trumpeter hornbills which attempted to breed in the Zoological Gardens in London the wall-plaster was fabricated from materials consisting of pellets regurgitated by the male 'although each consignment was "topped off" with a lump of moist clay carried in his bill'. He further reports that the masonry at the nest of another species of hornbill—a perfectly wild pair in this instance—

was elaborated, from insect remains, probably 'cast', and the decaying wood on the inside of the hole.

It may be objected that the first report relates to unnatural conditions of nesting and that the second is only problematical: nevertheless, unless chemical analysis proves it to the contrary, we cannot, in our present state of knowledge, eliminate the possibility of the plastering being made from materials 'cast' by hornbills, assuming that in the natural state they throw up such casts; which brings us to the subject of 'packets of seeds'.

The first reference to the matter which I can find is by Professor A. Newton. He records that 'hornbills at intervals of time, whether periodical or irregular is not yet known, cast the epithelial layer of their gizzard. The epithelium is ejected in the form of a sack or bag, the mouth of which is closely folded, and is filled with the fruit that the bird has been eating'. He added that what Science then (1896) wanted most to know was whether these castings were really intended to form the hen bird's food during her confinement. This observation, judging by the name with which it is coupled, appears to refer to hornbills in captivity and therefore not leading their natural lives. Next, Whistler remarks that 'this habit (feeding the female through the narrow entrance hole) is perhaps responsible for the curious fact, observed in captivity with reference to some species of hornbill, and perhaps connected with all, that at intervals the epithelial layer of the gizzard is cast in the form of a closed sack containing the seeds of fruit on which the bird has been feeding'. Finally, Pycraft informs us 'during her period of solitary confinement she is assiduously fed by the mate, her daily rations being passed to her in the form of a bolus, the investing coat being furnished by the inner lining of the gizzard of the male: at least that is the commonly accepted explanation of the structure of the capsule though it is probable that it may prove to be formed by a special glandular secretion. According to other accounts each meal is divided into from two to four pellets containing fruit seeds, insects, and portions of reptiles which the devoted cock transfers into the gazing mouth of his fair prisoner by a series of jerks'.

I cannot help feeling that Pycraft's account also refers to hornbills in captivity. In any case, nowhere can I find that a hornbill in the wild state, in Indian regions at all events, has been observed to feed his mate with 'packets of seeds'. It may be argued that the common grey hornbill referred to earlier, which I observed make over three slim, green pods like beans, and what I took to be a tamarind pod, in fact presented his mate with 'packets of seeds' or the food done up in epithelial gland-sacks. Such was definitely not the case even though I failed (only because I am no botanist) to identify definitely what the food was.

A matter which can with advantage be introduced here but concerning which there does not appear to be a great deal on record is the age of young hornbills when the female parent leaves the nest. The *Old Fauna* says of the Indian great hornbill that the female remains in the nest till the young are fledged; the *New Fauna* puts it slightly differently—'until the young are almost ready to fly'. *Nidification* gives yet another version and states the female sometimes leaves the nest when the young are but a few days old

but more often she stays with them until they are almost ready to fly. Of the Assam brown-backed hornbill Stuart Baker tells us that the female generally remains in the nest until the young are almost ready to fly, but adds that this is not always the case. Concerning the common grey hornbill the *Old Fauna* states that the female does not leave the nest until the young are about a week old, a statement which Whistler repeats; Salim Ali remarks 'until they are at least a week old'. Dewar reports that a nest of this species which he opened out had the female and three young inside; the eldest young one appeared to be some fourteen days old. M. Mushtaq Husain saw a female *T. birostris* emerge from a nest in which there were three young 'able to fly'. Another nest of the same species which he found, contained young. One young one was quite fourteen days younger than the others, whose ages, however, he does not appear to have estimated. Here the female had already left the nest. In the case of a common grey hornbill's nest which I was watching the female broke open the plastering and left the nest on 6th July; the young exactly a week later. Another *T. birostris* female whose nest I was interested in over a period of weeks was brooding three young of different ages, varying (judging by the volume of their calls) from a day or two old to possibly seven or eight days of age. This was on 11th May. The female did not leave the nest-hole till 4th June.

There is now yet another species of hornbill concerning which we have information bearing on the same subject. In 1935 I had the good fortune to watch from my hiding tent a female Malabar pied hornbill make good her escape from the nest; in this were two young ones. These I examined and judged to be from ten to fourteen days old.

An analysis of these first-hand observations makes it clear that it would be more correct to state that the female common grey hornbill does not make her way out until the young are about a fortnight old and not infrequently until just before they are ready to leave the nest.

We have seen that the female hornbill is in the main responsible for enclosing herself inside the nest-chamber though the male bird has also been known to assist in the operation. Which of the two is responsible for breaking down the plastering so that the female can leave the nest? And how is the end achieved? Again, there is little on record bearing on the subject and that concerning the Indian great hornbill only. Stuart Baker, describing the nesting habits of *D. bicornis*, states that the plaster when dry is so hard that it requires a strong knife or small hatchet to cut it away; therefore (he continues) it must be really hard work for the birds to remove it sufficiently to permit the female and young to leave the nest. It is not clear from this whether only one—and if so, which of the two—or both parents, takes an active part in releasing the female, or whether we are to understand that both the male and female knock the walling down to let out the young. D. S. Kaikini reports that the mother bird breaks the wall of the nest.

I have twice been in my *hide* when a female hornbill has made good her escape from the nest; the first time it was a common grey hornbill and the second a Malabar pied hornbill. In each

case it was the female who let herself out—she received no assistance in the matter from the male. The *modus operandi* employed in both instances was exactly the same—hard and constant hammering with the beak, for the space of roughly two hours, at the ‘cement’ bastions before they gave way. The noise made by the Malabar pied hornbill when so occupied was of such volume that before I realised who the author was I was under the impression it was produced by some wood-cutter felling a fair-sized tree higher up the hill. Here then, perhaps, we have the reason for the hornbill’s casque—a real and very necessary shock-absorber. This, however, cannot account for the male possessing such an appendage, unless further observations show that he sometimes (or even frequently) helps the female to knock down the stout defences.

What is the condition of the female when she comes out of the nest-chamber for the first time? One naturally expects to see a bedraggled-looking bird, thin, and very stiff from her long confinement. This is partly the case. On the two occasions when I have been present to witness the female’s departure I was impressed by certain facts: the very deliberate movements of the bird at the nest-entrance, accompanied by much calling—*chee-ee-chee-ee-chee-ee* in the case of the common grey hornbill, and yapping like a dog in the case of the Malabar pied hornbill; the stiff and laboured hop to an opposite branch close at hand; the subsequent wing flapping and tail shaking indulged in before the initial flight; the presence of the male bird in the same tree; her *neat* appearance, and finally the female’s remarkably plump condition. On both occasions the male (who did not demonstrate) flew away with his wife and it was literally hours before either returned to the nest, the female in each instance being the first to do so. The contrast in condition between these two females and a female grey hornbill caught in the nest-chamber by one of my men, when two of her eggs had hatched very recently and one egg was chipping, was most marked: she was then still moulting, and very thin. It would seem, therefore, that it is not due so much to the enforced incarceration as to the shedding of her wing and tail feathers that must be attributed the female’s run-down state of health; apparently also she picks up very quickly as soon as the moult is completed.

After the female has made good her escape from the nest, is the entrance re-walled, and if so, by whom? It is well known that the entrance is sometimes blocked up again after the female has left the nest; nevertheless very few appear to have commented on the fact, Prater remarking that after she leaves the nest the female *D. bicornis* rebuilds the wall. D. S. Kaikini makes a similar statement. Whether or not these statements are based on personal observations is not clear. Salim Ali, writing of the common grey hornbill, and apparently not in a position to report the facts from first-hand knowledge, is content to remark that ‘the wall is built up again’.

In my experience, the walls are at times rebuilt but this is by no means the general rule. I have now watched five nests of the common grey hornbill and one of the Malabar pied hornbill during several weeks, both prior and subsequent to the female leaving the nest, one of them for four consecutive years and another during

two alternate seasons. Only on two occasions was the entrance re-walled, both times at the one nest. I was not present to see who was responsible for the building, which in neither instance was the finished work of art created by the female when confining herself; on the other hand the work could not be described as *kutchā*. The entrance was wider and more irregularly shaped than the original one, sufficiently small, however, to prevent my hand going in. The material employed in the construction appeared to be identical with that used when enclosing the female.

Until recently I have always imagined that to one, or both parents, is due the credit for walling in the young, they considering that the young require the same protection until they are able to fly as was lately given the female. Now, however, it seems probable that neither parent is responsible for the work and that it is undertaken by the young themselves: this is what reliable observations in Africa have recently disclosed. Should this prove to be the case with Indian hornbills also, surely there can be no parallel in precocity to that shown by the infant hornbill as not only has it learnt at a very early age (not more than three or four weeks old perhaps), without previous experience or teaching, how to fashion the material and build the enclosing ramparts, but it apparently knows even better than the mother bird whether or no it is necessary to protect itself in the nest from possible enemies.

It will be interesting to learn whether one or both parents, or the young, are responsible for breaking down the walling when the latter are ready to leave the nest. Unfortunately the only occasion when I have been present to see young hornbills leave the nursery the entrance had not been re-walled. I think it will be found that the parents undertake the job as the 'cement' work is probably too hard for the young hornbill beak to tackle.

We have seen that the mother hornbill when in the nest is most careful with regard to its sanitation, that she either throws the droppings out or defecates outside the nest. The young, from what I have seen, are equally punctilious in this important matter, invariably defecating through the entrance slit, and with considerable force. The nest, on being vacated, is, from what I have noted, left in a sanitary state—no flies, no ants, no smell; in fact on one occasion I saw a pair of common mynahs take possession of a common grey hornbills' nest-hole the very day the latter's young vacated it. No spring-cleaning or tidying was necessary before it could be occupied. Certainly numerous feathers have invariably remained: which brings us to a matter of the greatest importance in the life-cycle of the female hornbill—the moulting of the wing and tail feathers.

As long ago as in Hume's time it was observed by F. Bourdillon, to whom was brought a female *D. bicornis* caught in the nest-chamber, that she probably could not have flown more than ten yards until the young feathers, which were just appearing, had matured. This record is an isolated one and it was apparently thought for many years that the moult in this instance was purely fortuitous. General Osborne, however, about thirty-five years ago, appears to have suspected that the female hornbill regularly undergoes a moult while confined in the nest, this, in his view, being

restricted to the shedding of her quill wing and tail feathers. This matter has since been confirmed by other observers but nobody seems to have noted whether the female undergoes a general moult of the body feathers as well, or how the moult takes place; also whether all the wing feathers are shed simultaneously, or only some at a time, and if it is the wing or tail feathers which are lost first. Humayun Abdulali, however, recently wrote a most interesting and helpful note on the subject. He says of a female Malabar grey hornbill taken off three naked young (two much larger than the third) that 'she had completed moulting her wings but the new quills were too short for use. The tail was also moulting, the new *rectrices* being only two inches long while four of the old feathers remained. There was no body moult'.

I have only once seen a hornbill before it left the nest. This was a common grey hornbill. Her nest was opened out when it contained two young recently hatched, and an egg chipping. Her new wing quills were about 65% matured. The tail feathers were approximately three inches long. All the tail feathers had been shed, and apparently together. This appeared also to have been the case with the wing feathers. I felt that the *remiges* had been dropped before the *rectrices*. There was no body moult. The bird was quite unable to fly. Other hornbill nests which I have examined after the female and young have left them, invariably had wing and tail feathers and a few body feathers inside. These last had quite likely come out in the course of preening operations.

One other matter remains to be noticed—the condition of the male when his wife leaves the nest. I have already remarked that considerable irregularity occurs among the *Bucerotidae* with regard to the laying of the eggs. In the majority of cases a week to ten days probably elapses between the female first going into the nest-chamber and the complete clutch being laid. Incubation with the smaller species not improbably takes about twenty-one days, and assuming that the young are a fortnight old when the female makes good her escape—we have seen that she sometimes leaves when they are appreciably older—we find that the female common grey hornbill is very likely in the nest for at least forty-five days. With the larger *genera* the period must be longer still. During the whole of this time the female is fed by the male who, for part of the time, has also to fend, unaided, for his children. The prolonged strain of this devotion to family cares *must* tell, and by the time the female emerges, he is, as my staff say, greatly reduced. Up to a late stage he retains a smart, jaunty appearance, but subsequently, it is my experience, he goes off rapidly. He must be indeed glad when the female joins him though I have not seen him show his feelings, unless he does this by calling repeatedly. Thereafter, there is no doubt, he eases off and his wife takes on the major rôle of feeding the young.

* * * * *

It will be seen that three problems await solution by the field naturalist:—

- (1) The manner and the order of the female hornbill's moult.
- (2) Who is responsible for walling in the young hornbills after



Common Grey Hornbill enticing the young to leave the nest with offerings of food.

the female has made good her escape—is this the work of one or both parents, or of the young themselves?

(3) Who breaks down the 'cement' walls to let the young out—the parents or the young?

The first presents some difficulty as it means the periodical removal of the masonry walls. (It will probably be found that the female encloses herself again each time the walls are removed). The operation can best be performed by slicing along the edge of the nest-entrance with a small knife. If the female hornbill is handled gently and released again inside the nest-cavity it is my belief that the birds will not desert. Great care will, however, have to be exercised lest the hen bird struggle and cause damage to the eggs. The second and third problems require patient and careful watching and now that attention has been focussed on the matter it is to be hoped that some ornithologist will soon fill in the gaps in our present knowledge.

ANALYSIS OF NEST 'WALL' OF COMMON GREY HORNBILL.

Lieut.-Col. S. S. Sokhey, I.M.S., Director, Haffkine Institute, Bombay, who very kindly made the analysis, writes:—

'The pieces sent consist of somewhat hard, greyish earthy material having a faint odour resembling that of dry cow-dung cakes. The material is brittle and arranged in layers. Pieces of wood, hay, scales of wasps and seeds of fruit, as are usually seen in bird droppings, are incorporated in layers of the brittle earthy material.

Microscopically. A variety of cells possessing organic and inorganic structure are seen. Some cells resemble the ova of worms like the taenia and ascaris which infest the human and animal alimentary tract, suggesting presence of excreta of animal origin. Fibres of vegetable origin are present.

Incineration. On incineration odour, resembling that of burning cow-dung cakes is omitted. When reduced to carbon-free state the ash amounts to 57.57% of which 88.4% is acid insoluble and 11.6% acid soluble.

The acid soluble fraction contains mostly iron. The acid insoluble portion consists probably of clay.

Conclusion. Macroscopic and microscopic examination and the smell of cow-dung during incineration show that animal excreta is present. The high percentage of ash, most of which is acid insoluble on the other hand shows that ordinary earth or clay is present in considerable amounts. The nest wall therefore is probably made of earth and animal excreta mixed together and in which organic matter, like pieces of wood and hay, etc., is incorporated.'—Eds.

THE HIGHLAND MACAQUE OF CEYLON.

BY

W. C. OSMAN HILL, M.D.

(With one text-figure)

For some years I have felt reasonably certain that the Toqué monkey (*Macaca sinica*) of the higher altitudes of Ceylon was sufficiently distinct to warrant description as a separate subspecies (*vide* Hill, 1939, p. 144). This statement was based chiefly on personal observations on living specimens from known sources in the higher hills, including some that were living in the writer's private collection from such localities as the Dolosbage Range. The museum material available for the necessary closer observations was, however, insufficient and such as it was appeared to show no great constancy of characters, many of the specimens from neighbouring localities being often intermediate between the already known races of the Toqué (*M. s. sinica* and *M. s. aurifrons*).

Recently, through the kind co-operation of the Forest Department of Ceylon, I have had material collected from the uppermost of the three geological terraces of which the land structure of the island is composed, and this proves that the real highland race is the monkey of this terrace and that those from lower or intermediate altitudes are merely annectant forms between the highland form and the lowland races.

I chose an adult male in good coat, collected on the Horton Plains in December 1941, as the type of the new subspecies, which is herewith described.

***Macaca (Zati) sinica opisthomelas*, subsp. nov.**

Size large, but not greatly larger than the lowland forms; limbs and tail relatively short and stout compared to the body length (details below); pelage long and dense; pileum especially exaggerated; general colour of upper parts dusky or greyish olive with bases of hairs almost black; hinder parts and tail with hairs dark grey, almost black, throughout; no rufescence on thighs; under parts scantily clothed with white hairs; cutaneous pigment greatly exaggerated, that in the corium of the ventral skin resulting in a much deeper blue than in lowland forms; the epidermic pigment elsewhere (lip margins, eyelid margins, auricles and palms and soles) also being more concentrated.

Some of the above characters need amplification :—

I. Body proportions.

The following are the flesh measurements of the type male and paratype female of *M. s. opisthomelas*.

TABLE I

Flesh measurements of *Macaca sinica opisthomelas*

	♂	♀
Body weight ...	6122.25 gms. = 13½ lbs.	3401.25 gms. = 7¼ lbs.
Crown-rump length ...	456 mm.	426 mm.
Tail length ...	498 mm.	448 mm.
Head length (occiput to most prominent point of muzzle) ...	130 mm.	107.5 mm.
Max. height of ear ...	49 mm.	36 mm.
Tip of tragus to Darwin's tubercle ...	39 mm.	25 mm.
Acromion to olecranon ...	131 mm.	132 mm.
Olecranon to wrist ...	134 mm.	133 mm.
Wrist to dactylion ...	77 mm.	84 mm.
Trochanterion to tibiale ...	143 mm.	117 mm.
Tibiale to heel ...	151 mm.	140 mm.
Length of foot ...	129 mm.	120 mm.
Bimammillary breadth ...	45 mm.	43 mm.
Suprasternale-thelion ...	65 mm.	53 mm.
Thelion-omphalion ...	165 mm.	125 mm.
Omphalion-symphysion ...	147 mm.	102 mm.
Biocular breadth ...	48 mm.	44 mm.
Interocular breadth ...	11 mm.	10 mm.
Nasal breadth ...	20.5 mm.	13 mm.

TABLE II

Somatic Indices of *M. s. opisthomelas* and Lowland Toques

Index	<i>M. s. opisthomelas</i>		Lowland <i>M. sinica</i>		
	Type ♂	Paratype ♀	Av. of 5 ♂♂	Av. of 2 ♀♀	Total av. of 7
Tail index ...	110	103	117.2	118	122.5
Fore limb-trunk index	58.1	62	59.38	66	61.2
Hind limb-trunk index	64.5	60.2	64.7	67.5	65.5
Intermembral index ...	90	96.75	92.3	98	93.9
Humero-radial index	102	100.5	99.6	96.85	97.4
Tibio-femoral index...	105.5	119	109	109.75	109.2
Foot index (i.e. ratio of foot length to hind limb) ...	43.6	46.75	40.5	43.25	41.3

The linear measurements in table I do not indicate a particularly large animal compared with lowland specimens, but by comparing the ratios of the limbs and tail with the trunk, as in Table II a series of important conclusions can be drawn. In the first place the tail forms but 110% of the crown-rump length, which for a Toque monkey is definitely short. Similar indices worked

out from the measurements given by Pocock (1939) for other races of *M. sinica* show proportionately a much longer tail, especially in females. I am not aware what measurement is meant by 'head and body' in Pocock's tables, but it cannot be far different from the one used here (crown-rump) so that the indices are fairly comparable. Allowing for this, the tail index in four adult males of *M. s. sinica* is 125.5, 123, 122 and 107, and in two adult females 131.5 and 131, indicating a longer tail than in the new form, especially in females. (The single anomalous individual with an index of 107 is suggestive of the tail having been incomplete). In *M. s. aurifrons* the average tail index of three adult males is 124 and of four females 121.5, which denotes a tail of similar proportions to that of typical *sinica*.

Similar results accrue from a statistical study of the other appendages, especially the limbs. Thus in the type male of *M. s. opisthomelas* the fore-limb, without the hand, forms 58.1 per cent of the crown-rump length, and the hind-limb, without the foot, 64.5 per cent of the same.

In seven lowland Macaques the fore-limb averaged 61.2 per cent of the crown-rump length and the hind-limb 65.5 per cent.

There is some variation in the intermembral proportions, but the hind-limb is almost invariably longer than the fore-limb (in one female lowland animal only was it less) but in the type of *M. s. opisthomelas* the fore-limb, without the hand, is only 90 per cent of the length of the hind-limb, whilst in the series of lowland Macaques examined it forms 93.9 per cent. The difference seems to be due chiefly to variations in the length of the fore-limb. The tibiofemoral index, which is remarkably constant in the lowland series (109.2) is much less in the highland animal (105.5). There is no significant difference in the proportion of the foot length to that of the rest of the hind-limb.

The differences are not confined to the length ratios, but also affect the girths of the appendages. All are proportionately thicker in *M. s. opisthomelas* than in the other races. The body weight indicates a larger animal than lowland forms. Pocock records 12 lbs. as the largest male of *M. s. sinica*, most of them being smaller; his records of *M. s. aurifrons* are smaller still.

11. Pelage.

1. Length of hairs.

The following measurements indicate the great length of the hairs on the regions stated.

	Type ♂	Paratype ♀
Anterior quadrant of pileum ...	75 mm.	69 mm.
Posterior quadrant of pileum ...	75	85
Lateral quadrant of pileum ...	94	96
Mid-dorsal region ...	75	80
Shoulder ...	70	46
Loins ...	50	34.5
Flank ...	65	49
Dorsum of base of tail ...	32	37
Apex of tail ...	27	12
Lateral aspect of upper arm ...	45-50	24.5
Lateral aspect of thigh ...	30-36	32
Chest ...	40	41
Abdomen ...	40	46

2. Colour of Coat.

Pileum. The general surface colour due to the superficial hairs radiating from the centre of the crown is pale straw colour, but the deeper hairs are darker, dull olive brown at their roots, but paler towards the tip. No contrasting colour occurs in the fore part of the pileum in the male, but it is yellow in the female.

Dorsal aspect of trunk, etc.: colour is darkest over lower thoracic and upper lumbar regions, and the corresponding region of the sides. Here the hairs are for the most part dull grey, darker at their bases, but paling towards their

tips, which present a yellowish tinge, giving a dull olive hue to the area in question. The nape, interscapular, scapular and the hip regions are brighter in colour from the greater degree of flavism of the hair tips, but there is no erythristic tendency in any of these areas. The scapular brightness is continued on to the extensor surface of the arm for a short distance and is not interrupted across the mid-line. It is however, demarcated from the nuchal transverse band by a darker collar on the lower neck. The coxal bright area is sharply separated from its fellow by a very dark area in the mid-line, but laterally it proceeds down the thigh as far as the knee. The tail is almost black on its dorsum and for half its length. It is paler at the sides and in the distal half on the dorsum as well, the flavistic tendency increasing to the tip. The more distal parts of the limbs are clothed with dark grey hairs with pale yellow tips.

Ventral aspect of the trunk, etc.: the under parts are more scantily haired with long white hairs. These also clothe the flexor aspects of the limbs. The white areas are sharply demarcated on the flanks and borders of the limbs from the parts clothed with pigmented hairs. The under surface of the tail has brownish white hairs, darker at the base. Hairs on the buttocks and perineum are very darkly coloured.

Face: this is much more densely haired with downy hairs than in lowland animals. The brows have short bristly hairs, black with straw-coloured tips. The nasal region and cheeks have a pale downy growth mixed with short black bristles. The usual whorl occurs on the preauricular region. It is chiefly composed of pale, almost white, soft hairs, but a few black bristles are mixed with them. There are some long soft white hairs behind the ear.

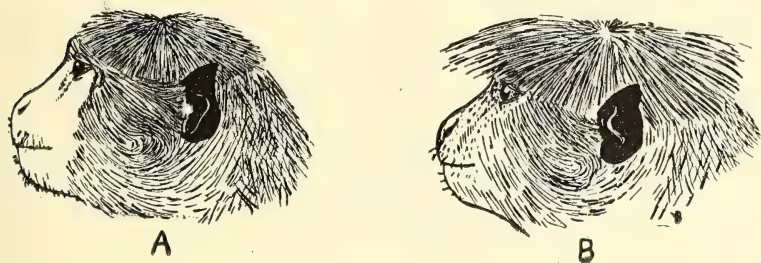


Fig. 1. Side view of head of A, typical Toque monkey (*Macaca s. sinica*) (after Pocock) and B, a highland Toque monkey (*Macaca s. opisthomelas*)

III. Pigmentation of Skin.

The general colour of the skin, both on the well haired and the relatively scantily haired regions is blue, due to pigment in the deeper or connective tissue layer. The blue is much deeper than in typical *sinica* or in *M. radiata*. The scrotum and the skin of the penis are devoid of this pigment and therefore appear pale flesh-colour.

Melanin pigment occurs in the epidermis and gives a blackish colour to the margins of the lips and eyelids and to the whole of the external ear, including the tragus and a few millimetres of the preauricular region. The palms of the hands are brownish-black with some irregular unpigmented patches,—four at the roots of the digits and a fifth on the ulnar 'heel'. The dorsum of the hand is darkly pigmented to beyond the wrist. The foot is similar to the hand, brownish-black on the plantar surface and black on the dorsum, the pigment extending proximally to just beyond the ankle. The nipples are pale flesh-coloured, but there are no pale areas in the axilla or groin.

IV. Skull.

The skull does not indicate a head any larger than that of other races of *M. sinica* according to the figures published by Pocock. The following are the measurements of the type skulls.

TABLE III

Measurements of skull of *M. s. opisthomelas* compared with those of an old male *M. s. sinica*.

	<i>M. s. opisthomelas</i> ♂	<i>M. s. opisthomelas</i> ♀	<i>M. s. sinica</i> old ♂
Cranial capacity ...	70 cc.	72.5 cc.	60 cc.
Total length, prosthion-inion.	112 mm.	93 mm.	108 mm.
Prosthion-basion ...	80 mm.	61 mm.	83 mm.
Glabella-inion ...	81 mm.	71 mm.	79 mm.
Basion-post-nasal spine ...	31 mm.	30 mm.	33 mm.
Max. cranial breadth ...	58.5 mm.	56 mm.	55 mm.
Basion-bregma ...	54 mm.	49 mm.	50 mm.
Bizygomatic ...	78.5 mm.	70 mm.	79.5 mm.
Palatal length ...	50 mm.	31 mm.	52 mm.
Bimaxillary breadth ...	35 mm.	36 mm.	39 mm.
Upper tooth row (excl. canine) ...	28 mm.	27 mm.	29.5 mm.
Foramen magnum breadth ...	14.5 mm.	13 mm.	14 mm.
Foramen magnum length ...	15.25 mm.	15 mm.	14 mm.
Condyllo-symphyseal length ...	77 mm.	63 mm.	84 mm.
Bicondylar breadth ...	60 mm.	44 mm.	61.5 mm.
Lower tooth row (excl. canine) ...	33 mm.	32 mm.	37 mm.
Oblique depth of symphysis menti ...	24 mm.	19 mm.	29 mm.
Transverse diameter of orbit...	24 mm.	21 mm.	23 mm.
Vertical diameter of orbit ...	21 mm.	19 mm.	19 mm.
Nasal opening, height ...	16.5 mm.	13 mm.	17 mm.
Nasal opening, breadth ...	12 mm.	11 mm.	13 mm.

The following qualitative characters of the type skull are of some interest. The infraorbital foramen is double bilaterally; the supra-orbital nerve occupies a notch on the right and a notch and foramen on the left. The right notch is guarded laterally by a very large bony spicule, itself pierced by a small foramen. The malar foramen is large.

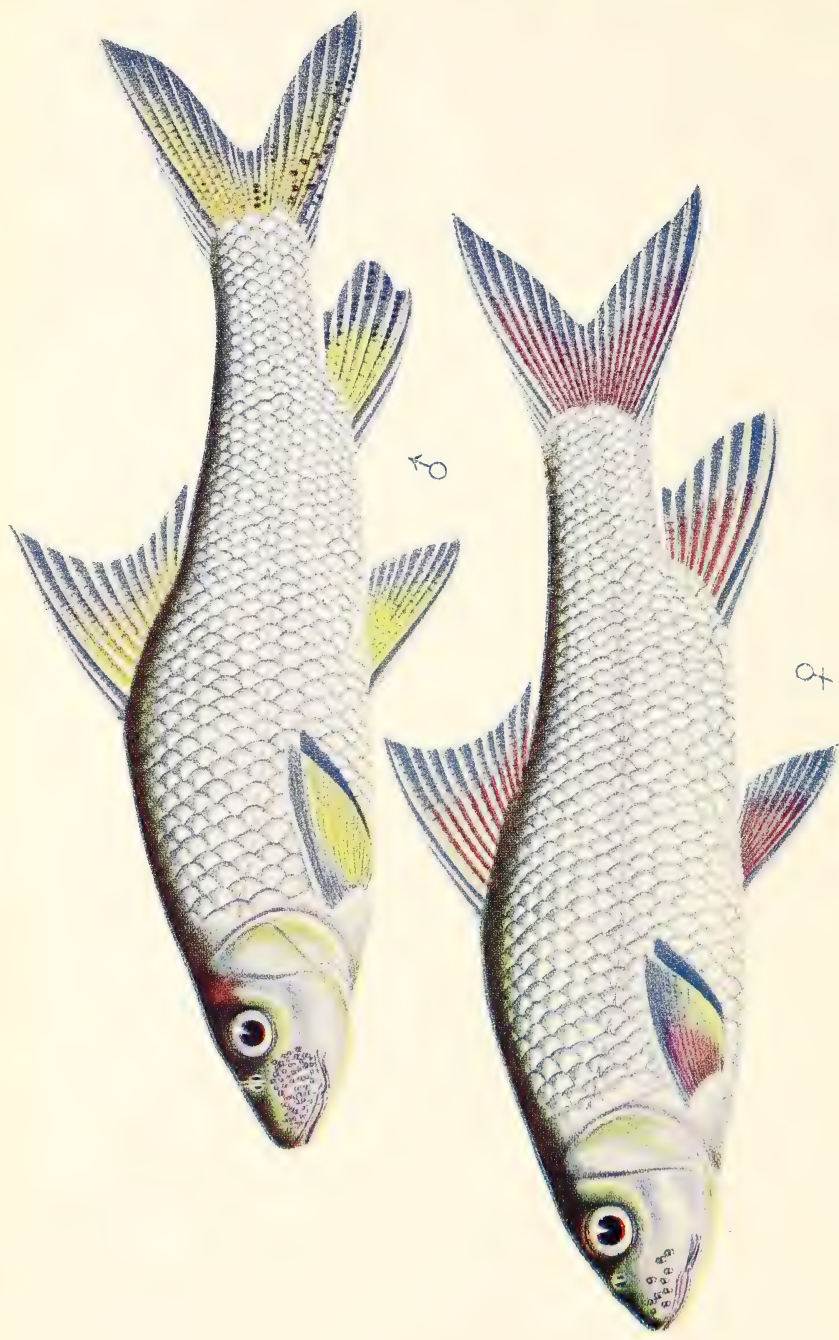
V. Habits.

This monkey inhabits the dense forest of the uppermost terrace which is a dissected plateau, with islands of forest, rising out of lower country. Its range is, therefore, necessarily rather discontinuous.

The type male had its cheek pouches and stomach filled with large round fruits which have been kindly identified for me by the Forest Department as those of the Dambu (*Eugenia Gardneri*).

REFERENCES TO LITERATURE.

- Hill, W. C. O., 1939, *Ceylon J. of Sc.*, xxi, p. 144.
 Pocock, R. I., *Fauna of British India*, Mammals, vol. i, 1939, pp. 34-42.



A. K. Mondal *del.*

BARBUS KOLUS (Sykes)

OBSERVATIONS ON THE BREEDING COLOURATION OF *BARBUS (PUNTIUS) KOLUS* SYKES.

BY

M. SUTER, D.SC.

(With a coloured plate).

Barbus kolus Sykes is one of the commonest fishes of the Poona waterways and was originally described from 'the Moota-Moola river, 8 miles east of Poona'. Sykes¹ observed that its small scales are 'silver-grey' and the back 'reddish silvery grey'. The fish is stated to grow to a 'length of 18 inches, and weight of 1 $\frac{1}{4}$ seer'. Day² extended the range of the species to 'Central Provinces, Deccan, and throughout the Kistna, Tamboodra, and Godavery rivers' and stated that it attains upwards of a foot in length. According to Day the colours are 'silvery, with a tinge of yellow: dorsal, caudal and anal tipped with grey'.

In 1941, at the request of Dr. S. L. Hora of the Zoological Survey of India, I made some observations on the species of *Barbus* found round about Poona and noticed that during the breeding season, June to August, the males and females of *B. kolus* could be readily distinguished by their respective colouration. During this season the general colour of the male is very silvery, with mother-of-pearl reflexes. The scales along the middle of the side and the cheeks are provided with pale pink reflexes. Very bright green reflexes occur about the head. The colour gets a little darker towards the back, which is brownish. The upper part of the head is distinctly brownish.

In the female, the fins are strongly tinted with pink, which is very prominent in the caudal and anal, especially along the rays. According to the local fishermen, these sexual differences in colouration are mainly confined to the breeding season and are less marked during the rest of the year.

It may be noted that in 1938, Hora and Misra³ pointed out certain secondary sexual characters, such as the nature of 'pearl organs', the form of the head and body and the structure of the dorsal and anal fins, by which the sexes in *B. kolus* can be distinguished. The colour differences noted above can be relied upon during the breeding season only.

After examining a large number of specimens, I found that individual fish show some variation in colouration, mainly about the head, which seems to become paler with age and size, and shows more of the bright green reflexes than is the case in smaller fish. • In

¹ Sykes, W. H.—*Trans. Zool. Soc. London*, II, p. 357 (1841).

² Day, F.—*Fish. India*, p. 573 (1878).

³ Hora, S. L. and Misra, K. S.—*Journ. Bombay Nat. Hist. Soc.*, XL, p. 28 (1938).

older fish the brown colouration of the back seems to become less and the scales of the upper parts of the body also show some greenish reflexes in the general mother-of-pearl scheme. The pink reflexes extend further from the median line and in the lower parts faint golden reflexes are noticeable.

In very young fish the brown colour of the upper parts of head and back is often very reddish.

The males of several species of Carp Minnows of the *Puntius* type are known to assume brilliant colours during the breeding season¹ but it is remarkable that in *B. kolus* it is the female that puts on gaudy colours to attract the males. In this respect, *B. kolus* is more human. It will certainly be of interest to work out the proportion of sexes in this species with a view to elucidate the unusual behaviour with regard to the breeding colouration of the two sexes.

My thanks are due to Dr. S. L. Hora for directing my attention to the literature cited here and for helpful suggestions.

¹ Mookerjee, H. K., Mazumdar, S. R. and Das Gupta, B.—*Ind. Journ. Vet. Sci. Animal Husb.*, XI, p. 250 (1941).

THE EARLY STAGES OF INDIAN LEPIDOPTERA

BY

D. G. SEVASTOPULO, F.R.E.S.

PART X.

(Continued from Vol. xliii, No. 1 (1942), p. 47).

HETEROCERA.

AMATIDAE (SYNTOMIDAE).

Amata (Syntomis) cyssea Stoll.

Ovum almost spherical, unsculptured. Milky white in colour, turning grey before hatching. Laid in small batches. Laid 9-ii-42. Hatched 15-ii-42.

Newly hatched larva—Head brownish grey. Body pale grey with sparse single greyish hairs. Very lightly pigmented, after feeding the colour of the food is seen clearly in the intestines.

2nd instar—Similar.

3rd instar—Similar but more deeply pigmented.

4th instar—Similar but the skin still more deeply pigmented and the hairing denser.

5th instar—Similar to final.

Final instar—Head deep brown. Colour of body blackish purple, slightly paler between the somites, and with a dark dorsal line. 1st somite with a dark dorsal plate bearing a few short hairs and a sublateral hairy wart. 2nd and 3rd somites with a large subdorsal and a small sublateral hair-bearing wart. 4th to 11th somites with a small posterior dorsal, a larger anterior subdorsal, a lateral and a sublateral hair-bearing wart. 12th somite with a subdorsal and lateral hair-bearing wart. The hairs are short and deep purple grey in colour. Legs purplish. Prolegs pinkish.

Pupa in a slight web. Pale chestnut brown, the abdominal somites with rings of slightly darker brown depressed spots. Thorax marked subdorsally with darker brown. Spiracles slightly raised.

Food-plant—Dahlia and Cosmos, preferring the flowers.

Described from larvae bred from ova laid by a Calcutta caught female, one of which pupated 12-iii-42, and a male emerged 21-iii-42.

LYMANTRIIDAE.

Dasychira mendosa Hbn.

Sevastopulo, *Journ. Bomb. Nat. Hist. Soc.*, xl, 404. 1938.

Ovum spherical, the top flattened. Colour pale cream, the micropylar area and a ring round the top pale butter yellow. Later the micropylar area becomes depressed. Immediately before hatching the cream colour turns bluish grey and the butter yellow a dingy

green. Laid in large regular batches. Laid 5-xii-41. Hatched 13-xii-41.

Newly hatched larva—Head black. Body greyish white with four transverse maculate black bands on the central and three on the posterior portion of the body. Clothed with long sparse dark hair. Venter grey, a yellow spot at the end of the body.

2nd instar—Head black. Body with the dorsum greyish, a blackish lateral stripe. 1st somite with a subdorsal orange tubercle. 4th to 7th somites with dorsal tufts of short black hair, 11th somite with a similar tuft. 9th to 11th somites blackish dorsally, extremity of body orange. Sparsely covered with longish black hair.

3rd instar—Similar but only the first three somites grey dorsally and these with a central black stripe. Rest of the body black, a subdorsal yellow line and a sublateral whitish-grey one. Dorsal hair tufts slightly more prominent.

4th instar—Similar to final (see above quoted reference) except that the lateral tufts are composed of simple black hairs only and the dorsal tufts, with the exception of that on the 7th somite, are black.

5th instar—Similar to final.

The larva of this particular brood were a much darker grey than normal, in fact some were almost black. In spite of this, however, none had the bright yellow dorsal tufts mentioned by Hampson. A few had the dorsal tufts very pale golden buff in the 5th instar but these moulted into the form with greyish white dorsal tufts in the 6th (final) instar.

Described from larvae bred from ova obtained from a Calcutta caught female.

Lymantria ampla Wlk.

Moore, *Lep. E. I. Co.*, ii, 346, pl. 15, figs. 7, 7a, 8, 8a.

Moore, *Lep. Ceyl.*, ii, 80, pl. 109, figs. 2a, 2b. 1882-83.

Hamps., *Fauna Brit. Ind.*, Moths, i, 460. 1892.

Strand, *Seitz Indo-Austr. Bombyces*, x, 323. 1923.

Ovum almost round, slightly flattened above and below, greyish pink and large for the size of the moth. Laid in a solid mass close to the cocoon and imbedded in and covered by hairs from the female's anal tuft.

Full grown larva—Head dark brown, the clypeus filled in with whitish and with a whitish streak from apex of clypeus to vertex. Body brown, varying from a pale café-au-lait to a fairly dark brown. 2nd somite with a blackish dorsal patch. 4th to 10th somites with a transverse black dorsal line posteriorly. A subdorsal black streak anteriorly on the 8th somite, the 7th and 9th sometimes with traces of a similar streak. 10th and 11th somites with a broad white irregular subdorsal band almost joining across the dorsum of the 11th somite, which may be obsolescent or obsolete. 1st somite with a subdorsal tubercle tufted with longish brown hair. 2nd to 11th somites with a subdorsal oval purple brown spot from which spring short brown bristles, and a pair of smaller dorsal spots, between the subdorsal pair on the 2nd and 3rd somites but rather

anterior to them on the others. 1st to 11th somites with a series of lateral tubercles tufted with brown hair. 4th to 11th somites with smaller sublateral tubercles tufted with brown hair. 12th somite with a transverse series of six similar tubercles. Dorsal glands on 9th and 10th somites dark purple brown. 12th somite with two subdorsal purple brown streaks. Legs brown. Prolegs brown with a whitish spot. Spiracles black. Venter slightly paler than the dorsum. The female larva is very much larger than the male in the last instar.

Pupa in a few netted threads. Brownish black with tufts of slightly curly hair, those on the head whitish grey, on the thorax blackish and on the abdomen greyish. Wing cases without tufts of hair. The tufts on the abdomen arranged in a dorsal, subdorsal, lateral, sublateral and ventro-lateral series. The female pupa is very materially larger than the male but the wing cases are disproportionately small.

Food-plant—*Lagerstroemia indica* Linn., *Crotalaria* sp., Palm, Mango and Casuarina. Moore states that the larva is almost omnivorous.

Described from a number of full fed larvae found in Calcutta, a male and female of which pupated 24-xi-41 and 25-xi-41 respectively and emerged 6-xii-41 and 4-xii-41.

Moore writes in *Lepidoptera of Ceylon* 'Larva brown, covered with short brown hairs, those from anterior and anal segments long; male with a pale subdorsal line and lower spots, some white spots along the back and below the pale line; female with blackish dorsal spots and a white lateral spot on the tenth segment; legs reddish. Pupa purplish-brown, slightly tufted with short hairs.' The figures of the larvae are anything but lifelike and those of the pupae are not hairy enough and too pale in colour. Hampson's description, which is copied in Seitz, seems to be based on that of Moore except that the head and legs are said to be ochreous.

BOMBYCIDAE.

Ocinara varians Wlk.

Sevastopulo, *Journ. Bomb. Nat. Hist. Soc.*, xl, 407. 1938.

Young larva—Head and body grey, a large subdorsal black spot on the 5th somite. A short fleshy curved horn on the 11th somite.

Full grown larva—Head dull brown. Body dull brown, the first four somites longitudinally striped with greyish and with transverse yellow lines only visible under a lens. 2nd somite with paired black dorsal spots. The dorsal area from the 5th somite backwards mottled and paler and brighter in colour, the lateral area from the 5th somite backwards dark chocolate brown. 5th somite with a double dorsal hump, the hump itself purple brown and edged in front with a black crescent-shaped mark. 8th somite with a subdorsal black spot joined to a dorsal purple brown spot and slightly raised. A short fleshy horn on the 11th somite. Venter, legs and prolegs dull brown. Some specimens more greyish. Others were a more uniform grey-brown, without the paler dorsum and

darker sides from the 5th somite backwards, the dorsal hump on some of these specimens pale pinkish-buff instead of purple brown.

Cocoon of closely woven white or yellow silk, rather papery. Boat-shaped and covered with a loose 'froth' of silk. Pupa pale yellow, very thinly chitinised.

Food-plant—*Streblus asper* Low. (Family, *Moraceae*) In captivity ate Peepul but not readily.

Described from a number of full fed larvae found in Calcutta; one of which pupated 13-xii-41, and a male emerged 20-xii-41.

I have described this larva as *O. varians* although I am not absolutely satisfied with the determination. The larva is very similar to that previously described but is considerably smaller and more knobbed, looking not unlike a small piece of twig. If my determination is correct, the variation seems to be analogous to that found in certain British Geometridae with a smooth and knobbed form of larva depending on the food-plant. I was very anxious to obtain a pairing and to see whether the resulting larvae, reared *ab ovo* on Peepul, would revert to the smooth form. Unfortunately the only female in the batch emerged when all the males were dead or dying. All my Peepul feeding larvae have spun cocoons of yellow silk, the present batch gave two yellow cocoons to eight white.

In my previous description, I described the cocoon as 'very closely woven and hard', the term 'papery' would probably convey my meaning better.

SPHINGIDAE.

Deilephila nerii L.

Sevastopulo, *Journ. Bomb. Nat. Hist. Soc.*, xl, 407. 1938.

A number of pupae bred from larvae found in Calcutta in January 1942 differed from the normal in having a subdorsal series of diffused black spots on the abdominal somites, in some cases the series was complete, in others reduced to the spots on the 9th and 10th somites only. One pupa had broad black bands across the dorsum and extending laterally almost to the spiracular black spots, this pupa also had a diffused black latero-ventral stripe. Larvae and imagines all normal. Bell and Scott (*Fauna Brit. Ind.*, Moths, v) do not mention any variation in this pupa.

LIMACODIDAE.

Parasa hilaris Westw.

Head pale brown, retractile. Body with a series of ten sub-lateral scoli, the posterior two blunt and whitish, the others green and slightly longer. A subdorsal series consisting of a bunch of green bristles, a moderately long green scoli tipped with red and armed with colourless bristles, a longer purplish red scoli armed with black bristles, five bunches of green bristles, a long purplish red scoli with black bristles and a shorter orange red one with colourless bristles. Ground colour of body green. A broad blue dorsal stripe with a median rose pink line from 2nd somite to the

base of the 2nd scoli. The bases of the 2nd pair of scoli connected by a transverse white stripe. A broad blue dorsal stripe between the 2nd and 3rd scoli, broadening at each end and edged by a darker blue line, a median rose pink line extending for two somites posterior to the 2nd and two somites anterior to the 3rd scoli. Between the 3rd and 4th scoli, the stripe is indicated by a continuation of the dark blue edging line. The whole stripe edged on either side by a narrow yellow stripe. A dark indigo blue subdorsal line, edged above by a yellowish green line. An olive green line, edged below by a yellowish green stripe, just above the sublateral series of scoli, and a similar line below. A yellowish green line dividing the sublateral and ventral areas. Venter a watery yellow green.

Cocoon of the usual hard Limacodid type. Oval, somewhat flattened, and with a surrounding and slightly concealing web. Colour pale olive brown, slightly tinged with golden. Empty pupa skin pale brown.

Described from a full fed larva found in Calcutta 26-xi-41, spun 30-xi-41, and a female emerged 19-ii-42.

NOCTUIDAE.

Mocis (Cauninda) undata F. (*archesia* Cr.)

Moore, *Lep. Ceyl.*, iii, 191, pl. 172, fig. 3a. 1884-87.

Hamps., *Fauna Brit. Ind.*, Moths, ii, 526. 1894.

Hamps., *Cat. Lep. Phal.*, xiii, 93. 1913.

Ovum—Very pale silvery green, spherical with numerous ribs running from micropyle to base. Laid singly. Laid 30-x-41. Hatched 2-xi-41.

Newly hatched larva—Brown, very long and slender. Very like a Geometer in its manner of moving and resting. After feeding becomes green.

Half-grown larva—Head whitish, striped with dark brown. Body greenish grey with nine longitudinal purple brown lines. A subdorsal black speck on the 4th somite. Venter with four purple brown longitudinal lines. 1st and 2nd pairs of prolegs obsolete. 3rd and 4th pairs, and also legs, almost black.

Full-grown larva—Head with the clypeus yellowish with an internal red line and with a red line from apex of clypeus to vertex. A semicircular blackish patch with three white lines running through it, the lateral area white with two double red brown lines. Body with the true ground colour yellowish, becoming a stronger yellow on the subdorsal and lateral areas, but the colour obscured to a large extent by the small specks composing the markings so that the dorsal area appears to be slate grey. Dorsal area with the following longitudinal lines composed of minute specks, a central orange brown line, double between the 4th and 10th somites, with five blackish grey lines on either side. Four orange brown subdorsal lines, below them a double line of mauve dots, a solid orange line and a wider solid canary yellow line. 4th somite with a subdorsal crescent-shaped white mark enclosing a black dot.

Venter dark olive brown lined with darker, the lines on the ventro-lateral area most prominent. A dark elongate median spot on the 7th somite and a smaller one between the claspers of the 8th somite. Legs bright red. 1st and 2nd pairs of prolegs aborted, 3rd and 4th pairs coloured as venter. Anal claspers striped in continuation of the body stripes. Spiracles black. In some larvae the central dorsal line is very little different in colour from the others and the subdorsal orange brown lines are a dull purple brown.

Pupa in a very small cocoon of white silk completely covered with leaves. Colour dark purple brown, the intersegmental areas of the abdomen chestnut, and thinly covered with a white bloom. Cremaster a bunch of six golden brown hooked spines. The apex of the abdomen longitudinally wrinkled and forming a surrounding series of blunt teeth.

Food-plant—*Rhynchosia minima* DC. (*Leguminosae*).

Described from a number of larvae bred from ova obtained from a Calcutta caught female, one of which spun 28-xi-41, and a female emerged 13-xii-41.

Moore's description is as follows:—'Larva semi-looped; with twelve legs; the dorsal and under-surface purplish-brown, minutely black dotted, the sides yellowish and longitudinally lined with red and a sublateral row of minute black dots; head with a brown and red lateral streak; front legs red, middle and hind legs brown. Pupa reddish; efflorescent. Feeds on *Desmodium*.' His figure is too short and stout. Both Hampon's descriptions seemed to be based on the above, although in the Catalogue he quotes *Indian Museum Notes*, v, 159 (1903) as his authority.

Phytometra (Plusia) chalcytes Esp. (*eriosoma* Dbl.)

Moore, *Lep. Ceyl.*, iii, 70. 1884-87.

Hamps., *Fauna Brit. Ind.*, Moths, ii, 570. 1894.

Hamps., *Cat. Lep. Phal.*, xiii, 486. 1913.

Head pale green with a very narrow blackish lateral line and with three minute black specks on each lobe. Body pale green, a narrow slightly darker green dorsal stripe edged by a slightly waved white line. Two slightly waved white subdorsal lines. A straight, and slightly broader, white lateral line edged above with darker green and with a minute black dot above it in the middle of each somite. A few white specks giving rise to short colourless hairs. Venter pale green sparsely speckled with white. Spiracles buff. Legs and prolegs pale green, the first two pairs of prolegs obsolete. Shape narrow in front and broadening to the 11th somite, which is slightly humped dorsally. One larva had the tarsi black.

Pupa in a double cocoon of thin white silk. Pupa with the dorsum pale chestnut with dark patches on the thorax, 1st to 3rd and 5th abdominal somites. The colour shades off laterally into the pale green of the venter. Leg, antenna and wing cases a clear olive green, the leg and antenna cases marked with darker olive, the wing cases, except for the costal margin, with an underlying chestnut colouration. Leg and proboscis cases projecting slightly beyond the edge of the wing cases.

Food-plant—Garden Hollyhock.

Described from a full fed larva found in Calcutta 31-i-42, pupated 3-ii-42, and a male emerged 13-ii-42.

Moore's description is 'Larva green, palest along the back; with indistinct longitudinal lateral and dorsal paler lines. Pupa green with black dorsal streaks. Feeds on species of *Ficus*.' Hampson bases himself on this description in the Fauna but omits the pupa. In the Catalogue he gives the following references and description:— 'Kirby, Butt. & Moths Eur., p. 270; Hffm. Raup. p. 134, pl. 35, fig. 8. Green with numerous waved whitish streaks on dorsal area and more distinct lateral stripe. Food-plants: *Urtica*, *Salvia*, *Echium*, *Marrubium*, in India on *Ficus*.'

GEOMETRIDAE.

Thalassodes veraria Guen.

Head bifid, pinkish buff in colour. Body pinkish buff, the ventral area tinged with green. Traces of a triple rose-red dorsal line, the intersegmental areas slightly tinged with rose-red. Anal flap triangular and ending in a sharp point. Under a lens the dorsum is sprinkled with minute white dots.

Pupa formed under litter at the bottom of the box. Colour pale buff, the thorax smoky brown, the wing cases smoky brown but paler than the thorax. Thorax with a double dorsal blackish line, three subdorsal blackish dots and the juncture between the pro-, meso- and meta-thorax blackish. Abdomen with a blackish dorsal stripe and with brown streaks and specks arranged roughly in transverse lines.

Food-plant—Garden Chrysanthemum, eating the flowers.

Described from a full fed larva found in Calcutta 17-xi-41, pupated 23-xi-41, and a female emerged 1-xii-41.

(To be continued).

SPAWNING OF CARP AND THEIR SPAWNING GROUNDS IN THE PUNJAB.

BY

HAMID KHAN, M.SC., LL.B. (Punjab), Ph.D. (Cantab), F.A.SC.

(With 5 text-figures).

In India, the Carp (*Cyprinidae*) are the most valuable of the fresh water fishes, the species most prized being the Rohu, [*Labeo rohita* (Hamilton)], Mirgal, Morakha or Mori [*Cirrhina mrigala* (Hamilton)], and Theila or Katla [*Catla catla* (Hamilton)]. These fish, though they grow rapidly in tanks and ponds, do not seem to breed in confined waters (Gupta, 1908), and are said 'to breed only in the running water of the river', (Bull. 2 Dept. Fish. Bengal, 1913). Day (1873, p. 26), however, mentions that 'in those tanks, which are always in communication with irrigation works or large rivers, many species of non-migratory fish breed, and also a few of the migratory ones'. Thomas (1897, p. 341), also describes his experiment at Valluam in the Tanjore District, where *Labeo* fry were introduced in 'a rain-fed pond of some three to five acres of waterspread', and remarks that, 'the natives were very positive that they never breed in ponds, but needed running water. I thought they might be induced to try breeding in a pond when they found it impossible to get to a river, and the event proved I was right. After a time, *Labeo* fry were caught very much smaller and more numerous than I had put in.' Dunsford (1911), too, narrates an incident at Hissar, where after the first heavy fall of rain at the commencement of the monsoon, large fish, namely, rohu, were seen rushing about over inundated ground and were either 'females full of ripe spawn or males full of milt'. In 1924, the author (Hamid Khan, 1924), observed that the Indian Carp could be made to spawn in tanks and ponds provided that all the conditions of their natural spawning grounds were taken into consideration, and that in the absence of proper facilities the fish become egg bound and the eggs degenerate in the ovaries. Recently, Majumdar (1940) has pointed out that 'the statement that the European carps breed in confined waters, while the bigger types of Bengal do not is not exactly correct. It has been observed that they also breed well in confined or semi-confined waters during the monsoon in this country.' He, however, admits that owing to unfavourable circumstances the carps in confined waters 'reabsorb their eggs in their system.'

The spawning behaviour of the Indian Carp is really very peculiar and requires thorough investigation. Observations on their spawning have been recorded by the Fisheries Staff from various stretches of water in the Punjab during the last 18 years and their spawning grounds have also been surveyed. As a result of these observations, an attempt has been made in this paper to discuss, *firstly*, the probable factors which induce the Carp to spawn under natural con-

ditions, and *secondly*, the possibility or otherwise of the spawning of Carp in confined or semi-confined waters.

A. SPAWNING OF CARP IN RIVERS AND THEIR TRIBUTARIES.

1. *River Beas*.—Observations on the spawning of Carp were recorded from River Beas and its tributaries, namely *Barnai Cho*, *Gural Nala*, *Karabara*, and *Western Bein*.

(i) *Barnai Cho*, *Gural* and *Karabara* streams (Fig. 1). In 1922, River Beas, which is one mile from *Barnai Cho* near the village *Mehtabpur*, where an observation camp was established, was in flood on the 15th July, and the next day, due to heavy local rains the river overflowed and flooded *Barnai Cho* as well. The same evening, the fish, weighing 4 to 8 lbs. each, approximately, from the river and *Barnai Cho* were observed rushing about over the inundated fields, where water was 9 to 12 inches in depth, were playing together and laying their eggs. The water in many places was hardly sufficient to cover their backs and the fish could easily be killed in any number with a *lathi* blow. Immediately after spawning the eggs were collected. The eggs were demersal and were lying on the submerged grass or in shallow pits in heaps, but were not sticking to each other. Each egg measures 1.5 to 2 mm. in diameter, but as soon as it falls into the water it swells to 2 to 3 times its size by the absorption of water by its outer membrane, which gives it a glassy bead like appearance (Hamid Khan, 1924). This watery sheath acts as a protective covering to the developing embryo. The eggs do not float, but are often carried by the strong current of the flood into the main stream where they can be collected by means of fine meshed nets as is done in Bengal.

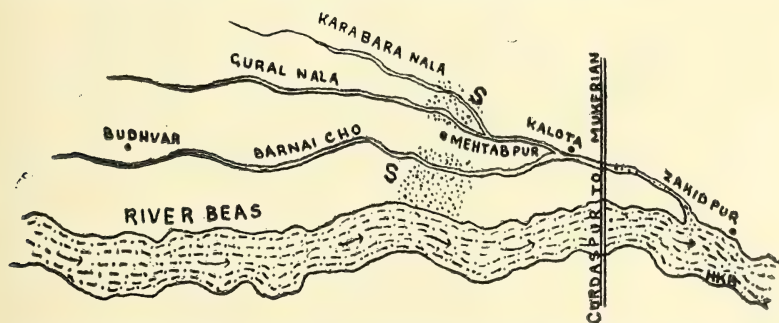


Fig. 1.—Diagrammatic sketch of spawning grounds (S) of the River Beas and its tributaries.

The temperature of water in the spawning grounds was 85°F. at 8 a.m., 81°F. at 4 p.m. and 82°F. at 7-30 p.m. The fish netted from the spawning grounds were *Labeo rohita* (Hamilton), *Labeo microphthalmus* Day, *Labeo gonius* (Hamilton) and *Barbus sarana* (Hamilton). Some of these fish were full of eggs and others were spent up. The latter were seen returning to the main stream.

Gural stream is hardly two furlongs from *Barnai Cho* near the village *Mehtabpur*, but this stream was not flooded with floods from the river on the 16th July. Consequently its fish did not spawn

on that day. It, however, rained heavily on the 29th July and Gural was flooded on the morning of the 30th, and Karabara on the same evening. Both the streams overflowed into the surrounding fields. On the 31st morning the fish were observed playing and spawning in the inundated fields where water was 4 to 5 inches in depth.

The temperature of the water of the stream on the 30th July was 78°F. at noon and the water in the spawning ground had a temperature of 80°F. on the 31st morning.

In 1934, Barnai Cho overflowed its banks due to rains in the up country on the 8th July and its fish spawned on that day. But the river Beas got flooded on the 16th July and overflowed into the fields and its fish spawned on the night between the 16th and the 17th July. Gural had its flood on the 26th July and inundated the fields at 11 a.m. and at 2 p.m. its fish were seen playing and splashing in the fields. The temperature of the water in the spawning grounds remained 87°F. throughout the day. A partly spent up female of *Labeo gonius* was netted from the spawning grounds, stripped and its eggs fertilized successfully. They hatched out on the 27th July, i.e., sixteen to seventeen hours after stripping.

(ii) *Western Bein*. Owing to rains in up country, the *Bein* stream was flooded on the 21st July in 1922. On the same evening it overflowed into adjoining fields near village Dhirpur, at a distance of three miles from village Manan Takwandi where an observation camp had been established. The fish from the *Bein* responded to the floods, moved on to the flooded fields along the current of water, rubbed themselves against the furrows of ploughed up fields, where depth of water was 2 to 18 inches, and made a noise like *boon boon*. The male closely followed the female, rubbed against its mate and both of them raised their caudal portions just above the water with their bodies pressed together. They remained in this position for 2 to 3 seconds, and it was thus that the female ejected its eggs which were immediately fertilized by the male. Due to muddy water the actual ejection of the eggs could not be seen, but it was noticed that in the females of *Labeo gonius* netted from the spawning grounds, when pairing, the eggs simply flowed out with slight pressure and were fertilized with the milt which a male yielded readily. Immediately the pair separated, they made great splashing noise. No fish stayed long at one place but wandered about with its mates. The eggs could be felt, by hand, lying at the bottom on the grass and were crushed when one walked in the water. When water was stirred the eggs came to the surface and were collected. Development started immediately after fertilization.

The temperature of the water of the *Bein* ranged from 84°F. in the morning to 94°F. in the afternoon. On the spawning grounds the temperature of the water on the 21st July at 11 p.m. was 85°F. and on the 22nd July it was 80°F. at 3 a.m.

2. *River Sutlej* (Fig. 2). Observations on the spawning of Carp in Budha Nala, a tributary of River Sutlej were carried out in 1929, 1931 and 1935.

In 1929, it rained heavily on the 18th July and flooded the Budha Nala, which overflowed into the surrounding fields, where fish were seen playing on the same day. One ripe female, *Barbus*

sarana, netted from the inundated fields, yielded its eggs readily and these were successfully fertilized by mixing milt from the male.

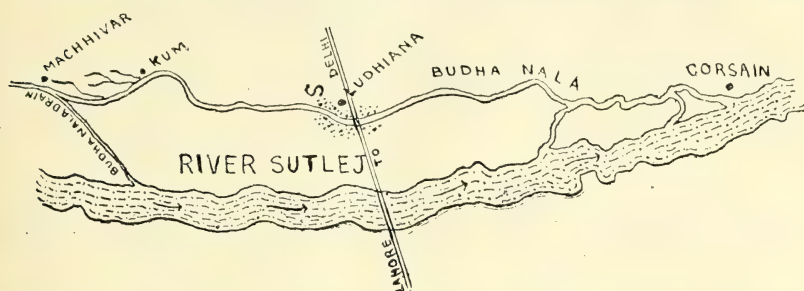


Fig. 2.—Diagrammatic sketch of spawning grounds, (S), of Budha Nala, a tributary of River Sutlej.

In 1931, the spawning in the *Budha Nala* was observed on the 22nd July, when the stream was flooded not with the local rains but with the rain at its upper reaches. In 1935, it rained on the 14th July, but the stream was not sufficiently flooded and the fish did not spawn. On the 18th July, there was another heavy shower, the stream overflowed and the fish spawned in the inundated fields.

Recently, the Irrigation Department, with a view to reclaim land from water-logged areas, have converted the upper reaches of the *Budha Nala* into a drain, thus preventing the stream from overflowing its banks during the rains. The fish, consequently, have been deprived of their natural spawning grounds.

3. *River Ravi*.—(i) *Jabboki spawning grounds*: With floods in River Ravi during monsoon, the fish of almost all kinds ascend to the inundated fields near village *Jabboki*, about 7 miles from Lahore, play together, lay their eggs and return to the river. When the floods subside, pools are left in the spawning grounds where numerous fry get stranded.

(ii) *Kiran Nala* (Fig. 3), known as *Doga* in its upper reaches and *Sakki* in its lower, is a tributary of River Ravi and joins it

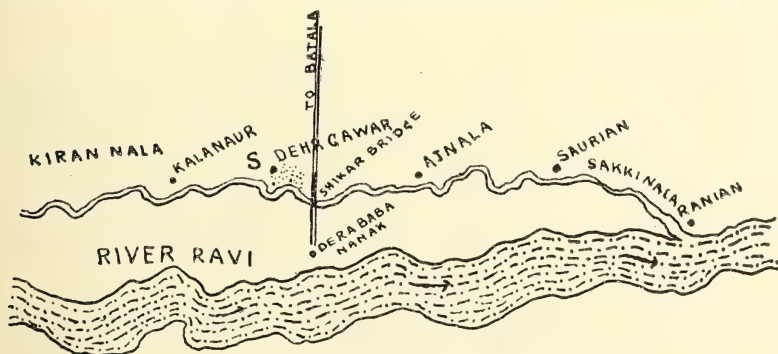


Fig. 3.—Diagrammatic sketch of spawning grounds, (S), of Kiran Nala, a tributary of River Ravi.

near village *Ranian*. Spawning grounds of fish extend all along the stream. Observations on the spawning of Carp were recorded

from one near *Dehr gawar* (Fig. 3. S). The stream, during monsoon, overflows into the fields near this village, where fish spawn and after laying their eggs return to the main stream.

Construction of a weir near Shikar Bridge on the *Kiran Nala*, for storage of water in its upper reaches for lift irrigation, has, of recent years, obstructed the passage of fish to their spawning grounds. It is a matter of regret that no facilities have been provided to enable the fish to reach their natural spawning grounds.

B. SPAWNING OF CARP IN TANKS WHICH ARE CONNECTED WITH STREAMS, RIVERS OR WITH ANY OTHER PIECE OF RUNNING WATER DURING THE MONSOON.

Such tanks and ponds are of two distinct forms, *firstly* those which always or nearly always contain water throughout the year, as for instance tanks at *Chhenawan* Fish Farm, and *secondly*, those which get dry during early summer and get inundated during the rains, as for example ponds at *Khori*.

(i) *Chhenawan Tanks*, (Fig. 4). Near village *Chhenawan* there is an old supply channel, extending to a distance of six miles upto the River *Chenab*, where a fish culture station, first recommended

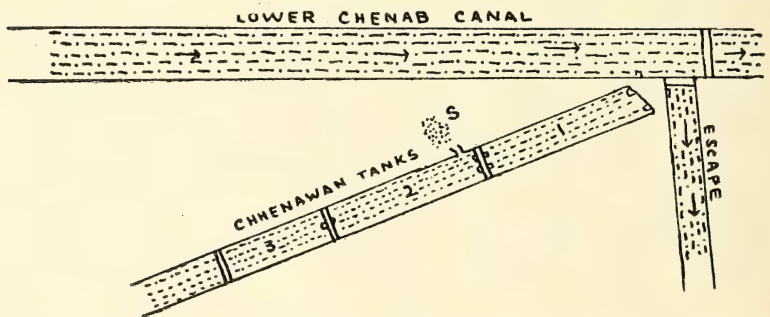


Fig. 4.—Diagrammatic sketch of *Chhenawan* Tanks, showing spawning grounds (S).

by Dunsford (1911, p. 13), was established in 1923. A portion of about two miles in length is utilized for this purpose and is divided into three parts by construction of earthen bunds. Adult Carp, such as *Labeo rohita*, *Labeo calbasu*, *Cirrhina mrigala* and *Catla catla* have been introduced into the second tank, which during the monsoon receives rain water through a storm channel and gets flooded. Its water overflows into the surrounding fields, where fish coming out of the tank, indulge in sexual play and lay their eggs.

During the last 18 years the Carp at *Chhenawan* have spawned four times only, i.e. once in 1923, then in 1928 and 1929 and again in 1933. The observations on their spawning recorded during these years are as under:—

1923.—It rained 2.65 inches on the 9th July and 1.55 inches on the 10th July. All the fields near the storm channel were under water and the fish were seen playing and spawning there. At 2 p.m.

the fish returned to the tank, as rain had stopped and water in the fields had gone low. The eggs, which were lying scattered, chiefly near the ridges of the fields, were collected. They hatched out on the 11th morning. The temperature of water was:

9-7-1923 Tank . . . morning 82°F., noon 84°F., evening 78°F.
10-7-1923 Spawning Fields: morning 76°F., noon 79°F., evening 78°F.

1928.—A heavy storm came on during the middle of the night of the 23rd July, and by the morning of the 24th the water from the fields was coming through the storm channel. About mid-day, the fish were noticed ascending the channel and there tremendous splashing took place and the fish were seen laying their eggs near the edges of the channel where water was shallow. A half spent up female of *Cirrhina mrigala*, netted from the spawning ground, yielded its eggs with a slight pressure on its abdomen. The eggs were fertilized with milt from a male and kept in hatching trays. They hatched out on the 25th morning, 17 hours after they were laid. The temperature of flood water on the 24th was 75°F. in the morning, 92°F. to 49°F. in the afternoon.

1929.—It rained 2.3 inches on the morning of the 17th July and at 2 p.m. the tanks, the channel and the spawning grounds were fully flooded, but no fish responded to the flood, till the morning of the 18th when they came out in shoals, played on the grassy banks of the channel and laid their eggs. One female *Cirrhina mrigala* was netted, when pairing, and it yielded its eggs readily, which were fertilized successfully. The temperature of water in the tank and the spawning grounds was as under:—

17-7-29 Tank, 9.30 a.m. 85°F., Spawning Fields 78°F.

18-7-29 Tank, 9 a.m. 82°F., Spawning Fields 80°F.

1933.—It rained 2.9 inches during the night between the 16th and 17th July, and the flood water began to flow into the tank at 8 a.m. The fish responded to the flood immediately afterwards and moved into the channel but did not lay their eggs. The eggs taken out of a female *Cirrhina mrigala*, netted from the channel, were found to be hard and opaque. It was at 5.30 p.m. that the first pair of *Cirrhina mrigala* was netted actually in the act of spawning. The female was half spent up and easily yielded its eggs, which were soft and translucent and were successfully fertilized when mixed with milt from a male. The spawning continued during the night as well. The temperature of the tank water before the flood on the 17th July was 78°F. and after the flood it was 80°F., while of the water where the fish actually spawned was 87°F.

During the remaining 14 years, the Carp at *Chhenawan* refused to spawn, because in most of the years the rain was either insufficient to flood the tank and the spawning grounds or not in time. Rain-fall at *Chhenawan* during the month of July for the years 1923 to 1940 is given in the Table and the dates on which the fish spawned are marked with an asterisk. Insufficient floods in June did not stimulate the fish and the floods caused by rains in August and September had no effect on the fish at all. In most of the years during which the Carp did not spawn the rainfall during the month of July was discontinuous and thus did not cause sufficient flood to inundate the spawning grounds. In July 1930, for instance, the

total rainfall for the month of July was quite heavy, but to prevent a breach in a newly constructed bund the level of the tank had been kept very low, *i.e.* 3 feet, and the individual rains did not bring in sufficient water to fill the tank to its flood level, *i.e.* to 9 feet. The fish, however, refused to lay their eggs in the tank, though the flood water from the surrounding land, caused by the rains, had flowed into it, but was not sufficient to flood the tank and inundate the spawning grounds. In 1938, it rained 3.8 inches on the 24th July, the channel and the fields were flooded, but the rain had stopped abruptly, the sun had come out and the temperature of the shallow water in the fields rose from 76°F. to 96°F. in the evening. The fish, which had responded to the flood and had entered the spawning grounds, returned to the main tank without laying their eggs. It was probably their instinct that warned them of danger of high temperature that threatened their eggs and fry if they had spawned in shallow water in the fields. Again, in 1940, the rainfall on the 12th July was quite heavy, but before the tanks could be flooded the rain had stopped. Subsequent rains in July in that year, too, were insufficient to flood the tank and the spawning grounds and the fish did not spawn.

(ii) *Khori Ponds* (Fig. 5). The fish from *Niki Deg*, a tributary of River Ravi, have spawned almost annually during the monsoon near village *Khori*. There are two ponds near this village which dry up in May and June, but get inundated with floods in the *Niki Deg* in July and the fish, ascending with the floods, play on the grassy banks of the pond and the surrounding fields, which are all under water, lay their eggs and return to the main stream.

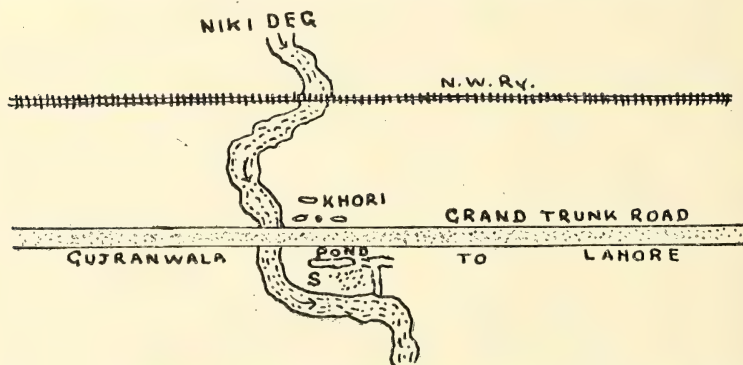


Fig. 5.—Diagrammatic sketch of spawning grounds (S), near village *Khori*.

When the floods subside, the pond is cut off from the main stream and numerous fry become stranded there. In 1940, more than 15,000 Carp fry, mostly of *Labeo rohita*, *Cirrhina mrigala* and *Catla catla*, were netted from this pond and transported to stock other waters.

C. SPAWNING OF CARP IN TANKS AND PONDS WHICH ARE ALWAYS UNCONNECTED WITH ANY LARGE PIECE OF RUNNING WATER.

Observations on the spawning of Carp were carried out on such tanks at *Lyallpur* and *Chhenwan* as are always unconnected with

any large piece of running water. The Carp in these tanks grow splendidly, become ripe in May and June, their ovaries become distended with eggs, but they refuse to lay them and become egg bound. Attempts to strip them in July result in hard, opaque eggs, which come out with great pressure and are often mixed with blood, and do not fertilize when mixed with milt from the male.

In 1934, and again in 1941, an artificial flood was created in a pond at *Chhenawan*, containing a few pairs of ripe Carp, by means of a pump. The fish responded to the flood, moved into the flood channel, but did not indulge in sexual play and returned to the main pond after a few hours stay in the channel. Apparently the conditions, which could induce spawning, were not reached.

Study of the eggs from ripe female Carp, netted in July and August from confined waters, showed that the eggs were hard and opaque. A condition, similar to one obtained at the time of spawning at *Chhenawan* and other natural spawning grounds, when the female readily yielded soft and translucent eggs, could not be observed at any time of the year in the fish confined in such tanks and ponds as are always unconnected with any large piece of running water. As the breeding season advances the eggs in the ovaries become smaller and smaller in size and are ultimately reabsorbed by the fish. It has, however, been possible to affect ovulation by injecting ripe female Carp with Antiturin S, Prolan or the extract of Anterior Lobe of Pituitary Gland. The injected fish yield eggs readily, but fertilization of these eggs by mixing them with milt from the male has not so far been successful (Hamid Khan, 1938).

The Indian Carp, therefore, do not breed in such confined waters as are always unconnected with any large piece of running water. In semi-confined waters, as for instance tanks at *Chhenawan*, these fish do spawn, provided that the tanks and the spawning grounds are inundated by timely rains. Their spawning behaviour, thus, differs from that of the European Carp, which have no hesitation to breed in confined waters (Hall, 1929), their eggs 'being adhesive become attached to the roots and stems of grass and other aquatic vegetation or to whatever objects chance to cover the bottom where they are deposited', (Gupta, 1938, p. 98). The behaviour of European Carp in this respect is similar to that observed in the case of smaller varieties of the Asiatic Carp, such as Gold Fish (*Carassius auratus* L.), (Hamid Khan, 1939) or *Barbus (Puntius) sophore*.¹

Such controlled or 'Test-Tube' cultivation, as is possible in the case of Trout (*Salmo fario* L.), (Hamid Khan, 1940) or in the Western Carp, is not at present practicable in the Indian Carp. One has to depend entirely on their natural spawning grounds for the supply of eggs and fry to stock other waters. At *Chhenawan*, for instance, whenever the Carp spawned, the eggs were collected, fry reared and transported to stock other waters. At *Khori*, too, the Carp fry have been utilized for the same purpose. A similar procedure is adopted in Bengal, where local fishermen collect the eggs

¹ *Barbus (Puntius) sophore*, one of the smaller varieties of the Carp, growing to 3 or 4 inches in length, has been observed to breed freely in confined waters, such as tanks and ponds, both at *Lyallpur* and *Chhenawan*.

from the natural spawning grounds, transfer them to hatching pits and rear the fry for sale for stocking tanks and ponds (Majumdar, 1940).

D. PROBABLE FACTORS WHICH INDUCE THE CARP TO SPAWN.

The study of the breeding habits of the Carp, seems to indicate that the probable factors which induce these fish to spawn are the following:—

1. *Rains.* The fish become ripe in May and June, and wait for the monsoon rains. With the first shower of rain in June, the fish move up the main stream in search of suitable spawning grounds and wait for the floods. If there are no rains or if the rains do not cause any flood, the fish do not spawn.

2. *Floods.* Whether caused by local rains or rains in the hills, floods constitute a very important feature in the spawning of Carp. With floods in the river and its tributaries, the fish leave the main channel and ascend the inundated fields to lay their eggs in shallow waters, which are quite suitable for the puny strength of the tiny fry that come out of the eggs within less than 20 hours. It is, therefore, not surprising that the floods which are insufficient to inundate the spawning grounds, or are untimely, do not stimulate the fish to spawn. Instinctively the fish will not lay their eggs in the main channel, where water is too deep, as the eggs, which sink to the bottom, will not have much chance to hatch out.

3. *Temperature.*—Rains and floods may induce the fish to ascend to their spawning grounds, but they will not spawn if the temperature is too high. The fish have been observed to leave the spawning grounds when the temperature rose from 76°F. to 96°F. The temperature in the spawning grounds generally ranges from 75°F. to 87°F.

4. *Chemical and Physical Factors.*—Analysis of water from the spawning grounds and from the main stream during the breeding of the fish did not show much difference either chemically or physically. Moreover, if it were chemical and physical constituents of the flood, which were mainly responsible for the spawning, the fish at *Chhenawan* would have spawned every year as the flood from the surrounding fields, caused by the local rains, invariably entered the tank during the monsoon. But they did not do so. It was only when the flood inundated the tank, the channel and the spawning grounds that the fish felt the urge to move out, play together and then lay their eggs.

5. *Endocrine secretion.*—It has been observed that when the fish first enter the inundated fields, their eggs are hard and opaque, and it is only when they have played together for a period lasting from 5 to 12 hours that their distended bellies become limp, eggs leave the follicles, become translucent and flow out of the vent on slight pressure. It is on such occasions that a female can easily be stripped, provided that the fish is ready to shed its ova, otherwise any attempt to press the eggs out results in hard and opaque bodies, which are often mixed with blood. It is, therefore, reasonable to believe that though rain, flood, temperature and chemical and physical factors induce the fish to ascend to their spawning

grounds and stimulate them to indulge in sexual play, some internal secretion is responsible for the ovulation and for change in the eggs that makes them translucent. It has been possible to make the Carp, kept in captivity, yield its eggs readily on stripping, by the administration of extract of Anterior Lobe of Pituitary Gland. This behaviour of the Carp seems to indicate that it is probably the pituitary sex hormone which is directly responsible for ovulation. The discharge of such hormone may be a consequence of some meteorological phenomenon as rain, flood or other chemical or physical environmental factors, (Hamid Khan, 1938).

5. *Domestication*.—The Indian Carp, it may be argued, is not yet fully domesticated. Its domestication is a recent event, while that of the European Carp is a century old. It is true that the male readily yields its milt and it is only the female that feels shy to part with its eggs in confined waters. In the years to come it may, however, be possible to induce these fish to spawn under control in confined waters when they find it impossible to get an access to a river or to any other piece of running water.

E. CONCLUSION.

Our inland fisheries have undoubtedly deteriorated due, chiefly, to untimely slaughter of fish, specially during their breeding time and destruction of their eggs and fry. Improvement of our indigenous fisheries by introduction of 'Test-Tube' or controlled cultivation is not a feasible proposition at present, and one has to depend entirely on the natural spawning grounds for supply of eggs and fry to stock the depleted waters. It is, therefore, recommended that deterioration may be prevented by adoption of such suitable measures as, *firstly*, proper facilities for the fish to ascend to their spawning grounds, *secondly*, protection, by means of legislation, of fish, of their ova and of their fry during their breeding season from wholesale destruction; *thirdly*, establishment of nurseries near the spawning grounds to ensure the development of eggs and fry and to lessen the chances of their destruction; and *fourthly*, salvage of fry from pools, where they become stranded after floods have subsided, and stocking the depleted waters with them.

F. SUMMARY.

1. Observations on spawning of Carp in the Punjab have been recorded *firstly*, from their natural spawning grounds on the Rivers Beas, Sutlej, Ravi and their tributaries; and *secondly*, from tanks at *Chhanawan*, *Khori* and *Lyalpur*.

2. The Carp in the rivers and their tributaries spawn in July when the streams are flooded by the monsoon rains and overflow into the surrounding fields. The fish lay their eggs in the inundated fields. The Carp, confined in tanks at *Chhanawan*, spawned when rainfall was heavy and the tanks, together with the spawning grounds, were flooded. During the years that the rainfall was either untimely or insufficient to flood the spawning grounds, the fish did not spawn and the eggs were reabsorbed by the fish. In the pond at *Khori*,

the fish from a tributary of the river Ravi obtained access to it during July, played on its grassy banks and inundated fields, laid their eggs and then returned to the main stream. In the tanks at *Lyallpur*, which are not connected with any large piece of running water, the Carp grow splendidly, become ripe in May and June, but refuse to lay their eggs.

3. Rain, flood, temperature and other environmental factors induce the fish to ascend to their spawning grounds and stimulate them to indulge in sexual play, but endocrinal secretion seems to be responsible for the actual ovulation.

4. The supply of Carp in our rivers and the replenishing of our depleted waters, at present, depends entirely on natural spawning of the Carp. To improve our inland fisheries it is, therefore, recommended that the fish may be protected from wholesale destruction during their breeding season and proper facilities afforded to them to ascend to their natural spawning grounds.

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TABLE

Showing Rainfall at Chhenawan in July for the years 1923 to 1940

Date	Rainfall in inches	Date	Rainfall in inches	Date	Rainfall in inches
1923		1924		1925	
9-7-1923	2.65	21-7-1924	0.25	9-7-1925	0.25
*10-7-1923	1.55	27-7-1924	1.80	10-7-1925	1.80
12-7-1923	0.50	28-7-1924	0.55	17-7-1925	1.00
17-7-1923	0.37		—	21-7-1925	0.70
20-7-1923	0.80	Total ...	2.60	24-7-1925	0.45
23-7-1923	2.65			28-7-1925	0.10
	—			31-7-1925	1.10
Total ...	8.52			Total ...	5.40

* The dates on which the fish spawned.

TABLE I—(contd.)

Showing Rainfall at Chhenawan in July for the years 1923 to 1940—(contd.)

Date	Rainfall in inches	Date	Rainfall in inches	Date	Rainfall in inches
1926		1931		1936	
10-7-1926	0.14	2-7-1931	0.65	4-7-1936	1.10
11-7-1926	0.80	5-7-1931	1.95	6-7-1936	0.60
26-7-1926	1.15	11-7-1931	1.80	7-7-1936	1.40
31-7-1926	0.50	13-7-1931	0.20	17-7-1936	0.50
	—	21-7-1931	0.70	28-7-1936	0.90
Total ...	2.59	23-7-1931	0.60	29-7-1936	0.30
	—	24-7-1931	0.30		—
	—	30-7-1931	1.60	Total ...	4.80
1927		Total ...	7.80		—
6-7-1927	0.23		—	1937	
7-7-1927	0.85		—	15-7-1937	1.35
9-7-1927	0.55	1932		16-7-1937	0.70
16-7-1927	0.45	12-7-1932	3.00	21-7-1937	0.54
22-7-1927	0.05	15-7-1932	0.50	22-7-1937	0.35
26-7-1927	0.40	20-7-1932	0.15	27-7-1937	0.25
27-7-1927	0.30	24-7-1932	1.50	28-7-1937	0.15
	—	28-7-1932	0.13	29-7-1937	0.05
Total ...	2.83	30-7-1932	1.00		—
	—	Total ...	6.28	Total ...	3.39
1928			—	1938	
1-7-1928	0.67		—	24-7-1938	3.8
21-7-1928	0.60	1933			—
22-7-1928	0.65	4-7-1933	0.30	Total ...	3.8
*24-7-1928	1.55	10-7-1933	0.30		—
25-7-1928	0.40	15-7-1933	1.10	1939	
	—	16-7-1933	0.65	2-7-1939	0.10
Total ...	3.87	*17-7-1933	2.90	8-7-1939	0.35
	—	19-7-1933	1.10	9-7-1939	0.27
1929		23-7-1933	0.10		—
3-7-1929	1.00	27-7-1933	0.50	Total ...	0.72
6-7-1929	0.30	30-7-1933	0.90		—
17-7-1929	2.30	31-7-1933	2.10	1940	
*18-7-1929	0.95		—	2-7-1940	0.50
19-7-1929	0.90	Total ...	9.95	5-7-1940	1.20
24-7-1929	0.20		—	12-7-1940	2.20
25-7-1929	0.90	1934		18-7-1940	1.75
28-7-1929	0.25	4-7-1934	0.40	21-7-1940	0.20
	—	7-7-1934	1.70	22-7-1940	0.90
Total ...	6.80	8-7-1934	1.30	23-7-1940	0.20
	—	28-7-1934	0.60	29-7-1940	1.00
1930		29-7-1934	0.40	30-7-1940	0.10
4-7-1930	1.55	30-7-1934	0.30		—
5-7-1930	0.55	31-7-1934	1.70	Total ...	8.05
9-7-1930	0.50		—		—
11-7-1930	1.10	Total ...	6.40		—
13-7-1930	1.00		—		—
14-7-1930	0.75	1935			—
24-7-1930	1.95	16-7-1935	0.80		—
25-7-1930	0.30	18-7-1935	1.20		—
27-7-1930	1.00	24-7-1935	0.90		—
29-7-1930	0.45	25-7-1935	0.16		—
30-7-1930	0.90		—		—
Total ...	10.05	Total ...	3.06		—

* The dates on which the fish spawned.

NOTES ON THE BIRDS OF BERĀR.

BY

MRS. M. D. WRIGHT.

Birds began to interest me six years ago and for the first time since then I was able to spend fourteen consecutive months in one part of India. During this period—October '39 to December '40 my husband and I toured extensively and very frequently over all the districts of Berār. This afforded excellent opportunities for bird watching for a mere student though much of it had to be done through the car windows.

D'Abreu's list of the birds of the Central Provinces, Sálím Ali's Birds of Central India and Hewetson's Birds of Betul in the *Journal of the Bombay Natural History Society* were of great interest as they dealt with those parts of Central India just north of Berār.¹ It seemed that the birds of the southern part of the C. P. deserved special mention as quite a number of species dubbed 'common in the C.P.' were not at all so in Berār, I therefore decided to keep as close a check as possible on bird occurrences, behaviour and movements just as they appeared to me. I am sure that the identifications are correct.

Included in Berār is the Mēlghāt, part of the Sātpūra range of hills in places over 3000 feet high. I only spent a few days in these hills in October, March, and May, but was able to observe enough to note some local migrations to and from the plains and differences in the bird life.

The plains of Berār are mostly flat cultivated fields with far fewer forested areas than the C. P. and high temperatures during the hot weather. The best tanks for water birds are Karunja, Kamgaon, Shegaon and Wādali.

All the identifications have been made from Hugh Whistler's *Handbook of Indian Birds*, that invaluable guide for students of Indian ornithology whether serious or not. Also a few from the 'Fauna.' There has been no murder done, field glasses sufficing for what the eye cannot see. Notes on breeding are badly lacking in this list. Opportunities for searching for nests were few, and bird life seemed strangely scarce during the rains as compared with other parts of India.

Races have not been dealt with and there are other species whose identities I could not be certain of and therefore have not mentioned. There are no new discoveries; but as Hugh Whistler mentions in the foreword of his book only by reports of those interested in the bird life of their own localities can the bird life

¹ See also 'The Hyderabad State Ornithological Survey' (*J. B. N. H. S.*, Vol. xxxvi, No. 2, et seq.) for birds of the area adjoining Berār on the south. Eds.

of India really be known. In trying to follow out his suggestion I have spent a most delightful year in Berār.

1. *Corvus macrorhynchos*. The Jungle Crow.

Common resident. Few and shy in towns and villages, plentiful in wilder areas. Flocks feeding on fruit in Chikalda in March, and on groundnut crops in the plains in September. Nests occupied from January to April.

2. *Corvus splendens*. The House Crow.

Common resident in the plains. Gives place to Jungle Crow in forested areas and Mēlghāt, though seen in those parts. Large flocks bathe in the late evening at edges of rivers and tanks in most populated parts before going to roost. Feeding on heads of juar in November. Many nests built in January, but breeding began about February.

3. *Dendrocitta vagabunda*. The Indian Tree Pie.

Fairly common in the plains in winter, favouring roadside trees, groves, and forested areas. In the Mēlghāt in November 1939 it was one of the commonest species and very noisy; in March they were still abundant in small parties and pairs, feeding on fruit, quarrelling and courting. In May comparatively scarce and quiet, and in October 1940 plentiful again.

4. *Parus major*. The Southern Grey Tit.

In the plains, usually single throughout winter. Sometimes in small parties. Rather scarce. Absent for hot weather and rains. Common resident in the Mēlghāt where they were seen in parties in November, and pairs in March and May.

5. *Machlolophus xanthogenys*. Yellow-cheeked Tit.

Uncommon in the plains. Sometimes seen in winter at Akot and Ellichpore at the foot of the Mēlghāt and in the wooded tracts of Yeotmal district. Abundant resident of the Mēlghāt where in November they were in parties with White Eyes and Grey Tits and in pairs in May when breeding.

6. *Sitta castanea*. Chestnut-bellied Nuthatch.

Distribution very localised. January 31st 1940 Ellichpur a single bird on a Banyan tree in fruit with many other birds in the rest-house compound. Common resident in Kandala Reserve forest, Yeotmal District; seen here in January, April, and June. Usually in company with the Indian Pygmy Woodpecker, White-browed Fantail Flycatcher, and Minivets. *Sitta frontalis* never seen.

7. *Turdoides somervillei*. Jungle Babbler.

Common resident in all the more wooded parts of the plains, and abundant in the Mēlghāt. Absent from open country, cultivation and towns.

8. *Argya caudata*. Common Babbler.

Resident in localised areas in the plains. Parties were usually seen at Balapur in scrub country by the river, the bushy surrounds of Khamgaon tank, and in areas at the foot of the Mēlghāt. Community trilling at roosting time seemed a marked characteristic.

9. *Argya malcolmi*. Large Grey Babbler.

Common resident of the plains. The common babbler of open country and towns throughout the province. Gives place to the Jungle Babbler in wooded parts. At Chikalda on May 27th 1940 a party on fairly open ground, there were none seen here in November and March.

10. *Pomatorhinus horsfieldii*. Deccan Scimitar Babbler.

Seen only in the Mēlghāt. March 21st 1940 just below the Chikalda plateau a party of two males and three or four females by a stream. May 28th Chikalda, a pair in lantana bushes.

11. *Dumetia hyperythra*. Rufous-bellied Babbler.

Was not seen in the plains. November 39, March 40, none in Chikalda; in May, very common in large parties at edges of forest areas and ravines; in October a few parties seen, but noticeably fewer.

12. *Chrysomma sinensis*. Yellow-eyed Babbler.

Not common, several in Amraoti in the long grass of a swampy area in January. Occasionally seen in most parts of the province. Probably resident.

13. *Alcippe poiocephala*. Quaker Babbler.

Was not seen in the plains. A party probably seen in Chikalda in May; but I am not certain.

14. *Ægithina tiphia*. Common Iora.

Common resident of the plains and Mēlghāt. Some seen in Kandala forest reserve in January appeared to have bright green upper plumage.

15. *Chloropsis jerdoni*. Jerdon's Chloropsis.

Uncommon in the plains. In December they were very common round Nagpur, and at the same time conspicuously scarce in Berār. Common in the Melghat.

16. *Molpastes cafer*. Red-vented Bulbul.

Common resident. From September to April in cheerful parties round trees in fruit and flower. Pairing off at the end of May. Many nests in June and July. One nest was built in a shrub at the edge of Buldana Circuit house. The parents entered and left the nest when no one was looking. It was immediately above last year's old nest and the pair are reported to build there every year. In Chikalda this bulbul occurs with the Red-whiskered bulbul, both species joining forces. They favoured lantana and cactus.

17. *Otocompsa jocos*a. Red-whiskered Bulbul.

Not seen in the plains. Common resident all over the higher parts of the Mēlghāt. In November in parties with Red-vented Bubbuls. Although they could be heard all day long, they remained very much within the undergrowth. In pairs in March and May. The White-browed Bulbul was not seen here; though it occurs in Nagpur.

18. *Saxicola caprata*. Pied Bush Chat.

Resident of the plains and Mēlghāt in all types of open country. *Saxicola caprata bicolor* with the whole abdomen white is a winter visitor. At the beginning of the hot weather the number of bush chats greatly decreased. Earliest date seen, October 16th; about this time there were many males with rusty-coloured abdomens, one was rufous from neck downwards.

19. *Saxicola torquata*. Stone Chat.

Common winter visitor to the plains. Rather scarce in the Mēlghāt. Latest date seen April 1st. Earliest, September 10th. Those seen on this date and for about a week after were few and far between and all females. By September 24th they were generally common and there were many males. Full winter plumage did not appear till January.

20. *Phoenicurus ochrurus*. Black Redstart.

Common winter visitor. April 3rd the latest date for the majority. On April 11th a solitary female was seen, no more after this date. September 17th earliest date: by October 1st generally common, especially in Yeotmal district.

21. *Cyanosylvia svecica*. Blue Throat.

Fairly common winter visitor to the plains. Seen skulking in damp localities. None seemed to attain perfect plumage.

22. *Saxicoloides fulicata*. Indian Robin.

Common resident.

23. *Copsychus saularis*. Magpie Robin.

Common resident of the Mēlghāt where at the beginning of May there was much singing and courting. Breeding by the end of May. In the plains they were common in winter, and very scarce in the hot weather and rains. Regions round tanks and roadside avenues were their favourite haunts.

24. *Turdus simillimus*. Nilgiri Blackbird.

Absent from plains. Common summer visitor to Mēlghāt; some are probably resident. Chikalda November 39, none seen, in March a few skulking very quietly in May in many parts of Mēlghāt they were abundant and very conspicuous. They did not appear to be breeding. Pairs would collect into parties that fed on the ground in shady patches. The usual call a deep chuck! chuck!; probably bred during the rains. In October, a very small party was deep among the undergrowth. Another Blackbird occurs in Chikalda which is probably the Malabar Whistling Thrush. It was not nearly so common.

25. *Monticola solitaria*. Blue Rock Thrush.

Winter visitor to the plains. Seen in most parts as a solitary bird usually perched on buildings or behaving like a flycatcher in wooded areas and roadside avenues. Latest date seen the last week in April at Basim, earliest October 6th Amraoti.

26. *Siphia parva*. Red-breasted Flycatcher.

Winter visitor to plains and Mēlghāt. It is common in Chikalda and in the more wooded localities of the plains. Very few seemed to have much red on the breast. By May they had disappeared from Chikalda and had returned in October.

27. *Muscicapula tickelliae*. Tickell's Blue Flycatcher.

Fairly common as a winter visitor to the plains in wooded parts, September 19th Akot earliest date. Common resident of Mēlghāt. Its song was the first to be heard at dawn. Probably breeding in May.

28. *Eumyias thalassina*. Verditer Flycatcher.

Winter visitor to the plains in wooded parts, only occasionally seen. In the Mēlghāt it is a winter visitor. In November 39 it was amazingly common sometimes being in small parties which I have never seen before. On March 23rd there was a pair in one of their favourite haunts though the rest had disappeared. In May I thought I saw a pair but might have been mistaken.

29. *Culicicapa ceylonensis*. Grey-headed Flycatcher.

An uncommon winter visitor. January 3rd Ellichpur, solitary with many other birds about a Banyan tree in fruit in the Dak Bungalow compound. I probably saw the Brown Flycatcher in Chikalda in October, but have never seen the Black-naped Flycatcher in Berār.

30. *Tchitrea paradisi*. Paradise Flycatcher.

Few and far between in the plains during the winter; about April 3rd they increased somewhat in the north of the district, very few in full plumage.

31. *Leucocirca aureola*. White-browed Fantail Flycatcher.

Common resident of the plains in wooded parts and roadside avenues. Abundant in Kandala forest area in mixed hunting parties in winter, in pairs in summer. Never seen in the Mēlghāt.

32. *Leucocirca pectoralis*. Spotted Fantail Flycatcher.

Common resident of the Mēlghāt. Never seen in the plains.

33. *Lanius excubitor*. Great Grey Shrike.

Resident of the plains, fairly common in very open country. Breeding in April and May. Two nests had lumps of cotton in the structure. Absent from the Mēlghāt.

34. *Lanius vittatus*. Bay-backed Shrike.

The commonest shrike. A local migration takes place between the plains and Mēlghāt. All winter and till the end of March when courting began they were extremely common, then they very noticeably decreased in numbers. On May the 4th they had greatly increased, in the Mēlghāt and breeding was in progress. Comparatively few seemed to breed in the plains. At the beginning of September they began to return to the plains and by the end of the month were in full force in all parts. In October there were many in immature plumage.

35. *Lanius schach ethronotus*. Rufous-backed Shrike.

Rather less common than the Great Grey Shrike. A winter visitor to the plains. Probably more common in the Mēlghāt. *L. s. caniceps* with less rufous on the upper parts was quite common round Nagpur in December, but was not seen in Berār. Absent for hot weather and rains.

36. *Lanius cristatus*. The Brown Shrike.

An uncommon winter visitor. The Black-headed Shrike was not found.

37. *Tephrodornis pondicerianus*. Common Wood Shrike.

Common resident, in wooded parts and roadside avenues. January 19th Kandala forest a party of about seven were with a hunting association. In March they were in pairs and whistling very pleasantly.

38. *Pericrocotus peregrinus*. Little Minivet.

Common resident in fairly well wooded parts. In January, in Kandala forests abundant in hunting associations. In March always seen in pairs. March 29th the first small family party. September in the Mēlghāt several family parties were about, the full-grown fledglings still being fed by parents. I did not see the short-billed or Scarlet Minevets.

39. *Lalage sykesi*. Black-headed Cuckoo-Shrike.

Rather uncommon. Usually seen singly. At Chikalda in May. At Amraoti on October 10th when four young birds were perched close together on wire fencing near the road.

40. *Graucalus javensis*. Large Cuckoo-Shrike.

Common in the plains and Mēlghāt. Locally migratory. November '39 Mēlghāt not noticeable. Winter plains—common, in small noisy parties with other birds round bur and pekul trees. March Mēlghāt mostly in pairs. A party of six were hawking insects. May Mēlghāt in pairs, no parties. Absent

during the rains. October 14th Yeotmal seen for the first time since the end of the hot weather.

41. *Dicrurus macrocercus*. King Crow.

Common resident of the plains. In the Mēlghāt they were commonest about March.

42. *Dicrurus longicaudatus*. Indian Grey Drongo.

Absent from the plains. In the Mēlghāt during winter they were in noisy parties among the tree tops. In March in pairs and less noticeable. Very scarce in May.

43. *Dicrurus coccyzoides*. White-bellied Drongo.

Locally migratory. Winter '39 fairly common all over plains usually solitary in more wooded areas than the King Crow. Absent from the Mēlghāt. March '40 absent from the plains, quite common in the Mēlghāt from the lower slopes upwards, still solitary but one or two pairs seen. May. Mēlghāt, common in pairs. Sept. Mēlghāt, still in pairs whistling beautifully and courting. Absent from the plains. October 14th earliest date seen in the plains.

44. *Dissemurus paradiseus*. Large Racket-tailed Drongo.

Not seen in the plains though there probably were a few in Buldana and Yeotmal districts. One in the Mēlghāt in May. Rather scarce.

45. *Acrocephalus stentoreus*. Indian Great Reed Warbler.

A winter visitor. Seen on two occasions only in December and January in thick clumps of reeds near Akola and Wadali tank Amraoti. A much smaller bird looking just like it was in the same patch of reeds and may have been Blyth's Reed Warbler.

46. *Cisticola juncidis*. Fantail Warbler.

In December there were several in long grass bordering Wadali tank; one mounted into the air in jerks with a clicking sound followed by a headlong dive down.

47. *Orthotomus sutorius*. Indian Tailor Bird.

Common resident. There are probably two races. Some seen in the plains had very richly-coloured upper plumage, these were seen at Pusad in January, Amraoti and Buldana in March. Others at the same time of year retained their dull plumage, these were in the majority.

48. *Franklinia gracilis*. Franklin's Wren Warbler.

Common in the plains in winter. None were seen during the rains. Very common resident in the Mēlghāt. Here they were in large parties throughout the winter till the end of May when they had paired off. They had complete dark pectoral bands. Coffee and Lantana bushes were favoured hunting grounds. In October '40 Buldana district a small party included a fledgling which was being fed. They still retained breeding plumage.

49. *Sylvia hortensis*. Eastern Orphean Warbler.

A winter visitor. In January near Jalgaon a party hunted with Rosy Pastors among bushes in fruit in open country. March 25th Wadali Tank Amraoti was the latest date seen.

50. *Sylvia curruca*. Lesser White Throat.

Winter visitor. Earliest date October 3rd at Yeotmal.

51. *Phylloscopus trochiloides*. Greenish Willow Wren.

Winter visitor. Seen in Kandala forest reserve in January. Not common.

52. *Phylloscopus inornatus*. Yellow-browed Warbler.

Winter visitor. Fairly common in the plains, common in the Mēlghāt. Earliest date October 3rd Yeotmal. I may be confusing it with another warbler. It had a pleasant whistle which was uttered usually from within a bush.

53. *Prinia socialis*. The Ashy Wren Warbler.

Surprisingly scarce. Only once seen during the hot weather by a stream near Jalgaon. None seen in the Mēlghāt. It is reported as being a common resident in the C.P.

54. *Prinia inornata*. Indian Wren Warbler.

Common round damp localities and cultivation. Another Warbler very similar in appearance appeared on September 12th at the edges of Khamgaon tank; they were in fairly large parties flitting about among grasses and weeds, sometimes settling together in a bush. After this date they could always be found there. Several other small Warblers were common all over Berār in roadside trees, specially Babul: but I am not certain of their identities.

55. *Oriolus oriolus*. Golden Oriole.

Common about roadside trees, and trees in fruit. In the plains there was a marked decrease during the hot weather and rains. In the Mēlghāt they were common in March and May.

56. *Oriolus xanthornus*. Black-Headed Oriole.

None seen in the plains. Fairly common in the Mēlghāt where they were in pairs in March. They sometimes joined with pairs of Golden Orioles at a fruity meal. No melodious calls, only those like a crow with a high-pitched voice.

57. *Pastor roseus*. Rosy Pastor.

A common winter visitor especially to the plains. From November 39-January 40 they seemed to keep to the west and north-western districts and were seen in large and small parties round cultivation often with other mynahs. Plumage was very obscure and bedraggled then. By the end of February when *Butea frondosa* was in full bloom their numbers seemed to increase; greatly and large parties could be seen and heard all over Berār wherever the trees were. Plumage was now cleaner and tidier. Latest date March 30th Yeotmal. They disappeared suddenly. Earliest date September 23rd, Wadali tank, Amraoti. After this date they were often seen in all parts of Berār.

58. *Sturnus vulgaris*. Starling.

A solitary bird on December 31st near Wadali tank Amraoti. This may have been a straggler from a small flock. No other occurrences.

59. *Sturnia malabarica*. Grey-headed Mynah.

Only once seen October 18th '40. Quite a large flock which had joined forces with common and Brahminy Mynahs and Rosy Pastors. They perched on bare trees having fed on an orchard.

60. *Acridotheres tristis*. Common Mynah.

Very common resident of the plains. Locally migratory to the Mēlghāt. November '39 Mēlghāt, Not one to be seen.

March '40	„	In large flocks everywhere, the most abundant species.
May '40	„	Still very common but pairing off.
October	„	None.

During the hot weather and rains the numbers in the plains decreased slightly only and breeding began in June, in some cases two broods were

raised. By the end of September they had acquired new plumage having looked very ragged at the beginning of the month.

61. *Temenuchus pagodarum*. Brahminy Mynah.

Common resident. Searching for nesting sites began in mid-May, breeding in June. Some pairs used the old nest hole as a home long after the chicks had gone.

The pied mynah which I noted as being fairly common in localised patches in and round Nagpur was quite absent from Berar. Neither were the Bank Mynah or the Jungle Mynah seen.

62. *Ploceus philippinus*. Baya Weaver Bird.

Common all over the plains during the breeding season, but not noticed at any other time. There were scattered nest colonies but no weavers till the first week of July when a small party of males appeared at an old colony, and had begun a few nests. Breeding was not in full swing till August. They had gone again by the end of September.

63. *Uroloncha malabarica*. White-throated Munia.

Common resident. February and March was the general breeding time. By the end of March small family parties were about, after this they were seldom seen in pairs.

64. *Carpodacus erythrinus*. Common Rose Finch.

Scarce. A small flock near Wadali tank Amraoti at the end of November 1940.

65. *Gymnorhis xanthocollis*. Yellow-throated Sparrow.

Very common in winter in flocks. They began coming in about November. From the end of February their numbers greatly decreased. In March, April and May several pairs were breeding in wooded areas. They were not seen at all during the rains.

66. *Passer domesticus*. House Sparrow.

As usual in the plains. None seen in the higher parts of the Melghat as Chikalda.

67. *Emberiza huttoni*. Grey-necked Bunting.

I identified this bird from the 'Fauna'; it was the only description that fitted it exactly. Common winter visitor in parties on dry stony areas and also near margins of tanks. Latest date April 11th. Earliest October 5th when a small party were on the same bit of stony scrub as they had favoured the year before. I have seen no bird answering to the description of the White-capped Bunting.

68. *Emberiza melanocephala*. Black-headed Bunting.

Common winter visitor in flocks to the plains. Feeding on ripe juar in December, and wheat in January. The numbers greatly increased from March which was probably the spring passage north. By the end of March most of them had departed. A few remained on till the beginning of April. Earliest date October 3rd '40 a small flock in Yeotmal District.

69. *Emberiza bruniceps*. Red-headed Bunting.

Seen in March only. March 14th with Black-headed Buntings round an enclosure where wheat was being husked and later a small party grazing by themselves at Mekah. None seen after March 26th. They must have been on passage.

70. *Melophus lathami*. Crested Bunting.

Resident. Quite common in North Berār in localised bushy patches. They were always to be found in a certain area near Akot. Appeared to be very scarce in the rest of Berār.

71. *Riparia chinensis*. Indian Sand Martin.

All the year round about tanks and rivers. Also at Chikalda over Bir Talau in March.

72. *Riparia concolor*. Dusky Crag Martin.

Common about buildings and ruins. At Balapur in February a pair were busy lining their nest built on a ledge of a ruined shrine with downy white feathers.

73. *Hirundo rustica*. European Swallow.

Winter visitor. Quite often seen with other swallows over tanks.

74. *Hirundo smithii*. Wire-tailed Swallow.

Common resident. In parties in winter hawking over tanks and perched on telegraph wires near water. In January the majority had shed their wire tails.

75. *Hirundo daurica*. Red-rumped Swallow.

Common. All winter in the plains they sailed low over the crops in the mornings and evenings. In the early mornings they were perched in very large numbers on telegraph wires. Compared to districts round Poona, swallows in winter kept much more to their own species when perched on telegraph wires. Very few collections of mixed swallows were seen. Another swallow often seen over water specially in winter was probably the Cliff Swallow, though I am not certain of this.

76. *Motacilla alba*. White Wagtail.

Common winter visitor. Latest date March 25th. The first Wagtail to leave. Earliest date October 10th. They came in suddenly and were seen in many parts during the next three or four days.

77. *Motacilla maderaspatensis*. Large Pied Wagtail.

Resident of the plains. Breeding in the hot weather.

78. *Motacilla cinerea*. Grey Wagtail.

Fairly common winter visitor. Seen singly about streams. Latest date April 10th. Earliest date October 12th in Buldana district.

79. *Motacilla flava*. Yellow Wagtail.

Fairly common winter visitor to the plains in flocks small and large. Latest date, a pair on May 2nd. Earliest date September 25th at Risode, a party of a dozen in attendance on grazing cattle. The next day a large flock were bathing in the river at Nandura.

80. *Motacilla citreola*. Yellow-headed Wagtail.

A frequent winter visitor. Several were always to be seen round the margins of Karunja tank in winter. At the beginning of March two or three pairs arrived at Wadali tank Amraoti for the first time, the males having the complete head to the nape bright yellow. Last date April 30th.

81. *Anthus hodgsoni*. Indian Tree Pipit.

Common winter visitor. At the end of March they had gone from the plains but parties were common from the lower slopes of the Mēlghāt up to Chikalda. By May they had gone.

82. *Anthus rufulus*. Indian Pipit.

Common winter visitor. Flocks and small parties on grass land and cultivated fields.

There were several other species of Pipits which I was not able to identify definitely. One is much larger, another has a very heavily streaked breast. This Pipit was absent throughout the hot weather and rains returning in September. Only one kind remained, a few of these were round Kamgaon tank in May.

83. *Alauda gulgula*. Little Skylark.

Common. On March 18th a large number were running about the edge of Wadali tank with Grey-necked Buntings.

84. *Calandrella brachydactyla*. Short-toed Lark.

Common winter visitor to the plains, more noticeable in the southern parts of Berār round Basim and Risode. Their flights over arid patches of ground were most fascinating. Earliest date October 10th at Basim.

85. *Mirafra erythroptera*. Red-winged Bush Lark.

Common resident in the plains. All the year round on the same patches of bare stony ground or perching on fences.

86. *Ammomanes phoenicura*. Rufous-tailed Lark.

Common in the plains. During the spring and hot weather they were one of the most abundant species seen along the roads, mostly in pairs. As soon as the rains broke they seemed to disappear, very few were seen. On September 20th there were a few roadside parties and by the end of the month large parties were common.

87. *Eremopteryx grisea*. Ashy-crowned Finch-Lark.

Common resident. Small flocks in winter.

88. *Zosterops palpebrosa*. White Eye.

Common resident of the Mēlghāt. Fairly common in the winter in the plains in hunting associations about wooded areas and trees in flower and fruit. None noticed during the hot weather and rains.

89. *Cinnyris asiaticus*. Purple Sunbird.

Common resident. The only Sunbird seen in Berār. October 26th '39 at Amraoti males were just coming in to breeding plumage. In March there were many nests. By April parties were delightfully active over Siris blossom. One nest had an egg in May. There were several Flower Peckers, mostly in the Mēlghāt. Among them was probably the Thick-billed and Tickell's Flower Peckers.

90. *Pitta brachyura*. Indian Pitta.

Absent from the plains. In May several skulking in lantana bushes and cactus in Chikalda. They probably bred in the Mēlghāt. None in the winter.

91. *Dryobates mahrattensis*. Mahratta Woodpecker.

Fairly common resident, seen singly throughout winter, very often among Babul trees that fringe the tanks and in wooded areas with hunting associations. In March in the Kandala forest reserve, they were in pairs.

92. *Brachypternus benghalensis*. Golden-backed Woodpecker.

Fairly common in wooded areas and roadside avenues. One in the middle of Amraoti town with a party of grey-headed Barbblers. Very few were seen between April and September.

93. *Dryobates hardwickii*. Indian Pygmy Woodpecker.

Fairly common in wooded parts. Usually in company with mixed hunting parties. In pairs in March.

94. *Thereiceryx zeylanicus*. Green Barbet.

Absent from the plains. Common resident of the Mēlghāt.

95. *Xantholæa hæmacephala*. Coppersmith.

Common resident. Nesting in March.

96. *Lynx torquilla*. Wryneck.

Uncommon winter visitor. January 26th at Basim a solitary bird was chased by a Bay-backed Shrike, it squeaked like a muskrat and wore an air of embarrassment. December 10th at Amraoti, also solitary trying to hide in a bush.

97. *Coracias bengalensis*. Blue Jay.

Common resident of the plains. Courting in February, the same behaviour was noted again in November.

98. *Merops orientalis*. Green Bee-eater.

Common in the plains and locally migratory. Throughout the winter they were abundant in parties everywhere. Pairs in the hot weather. At the beginning of the rains they were missing. In September they began to return and by November they were as abundant as ever.

99. *Merops superciliosus*. Blue-tailed Bee-eater.

In localised patches. April 10th Kamgaon tank a large flock was hawking red dragonflies, they had not been there either in February or March—after this they could be seen in every month in the same locality. A few were noted in April and September at Balapur and Akot.

100. *Ceryl rudis*. Pied Kingfisher.

Fairly common resident. About rivers and streams, very often in pairs.

101. *Alcedo atthis*. Common Kingfisher.

Frequent but the least common Kingfisher.

102. *Halcyon smyrnensis*. White-breasted Kingfisher.

Fairly common resident. Very noisy in March.

103. *Tockus birostris*. Grey Hornbill.

Common and very often in parties in winter. None seen during the rains.

104. *Upupa epops*. Hoopoe.

Common, a marked decrease in numbers during the hot weather and rains. In March there were a few in the Mēlghāt where I had not noticed any during the winter.

105. *Micropus affinis*. Indian Swift.

Common resident; though few in the Mēlghāt. In flocks over towns and villages. The Alpine Swift probably occurs in the Mēlghāt; some were hawking over a tank in the Fort at Chikalda in November, but I am not sure of their identity.

106. *Cypsiurus batassiensis*. Palm Swift.

Seen here and there near palm trees.

107. *Hemiprocne coronata*. Indian Crested Swift.

Common resident in certain localities only. In Kandala forest reserve Yeotmal district in a certain valley they could be seen at any time. Sailing overhead in parties in winter in pairs in March when they were probably breeding as they spent much of their time perching. In Chikalda small parties hawked over Bir Talau in March, May and October.

108. *Caprimulgus asiaticus*. Indian Nightjar.

Common in June. In Kandala Forest Reserve Yeotmal District; two barking deer dashed straight towards me being fiercely chased by a nightjar, it froze to a rock on seeing me. This was in broad daylight.

109. *Cuculus canorus*. Cuckoo.

Fairly common in April and May. Neither heard nor seen at any other time of year.

110. *Hierococcyx varius*. Common Hawk Cuckoo.

Common from May till the end of September. Heard for the first time in Berar on May 5th at Ghatang in the Melghat. Towards the end of July they were very noisy all through the night, very much quieter in August and after a final outburst, silent from mid-September though frequently seen till about the end of the month.

111. *Cacomantis merulinus*. Indian Plaintive Cuckoo.

Only once seen and never heard, a solitary bird on November 17th on the Buldana Ghat.

112. *Clamator jacobinus*. Pied-crested Cuckoo.

Erratic occurrence. Quite common in October till the beginning of November '39 near cultivation. The earliest reappearance was reported by Mr. R. Hill at Buldana on June 15th when he saw a pair courting. On June 21st a pair in the Kandala forest reserve were also courting. No more were seen when I left the province in December.

113. *Eudynamis scolopaceus*. Koel.

Earliest date February 1st none had been seen or heard from October '39. On April 5th '40 the first call was heard at Amraoti and they were frequently seen and heard till the end of July. After this there were no more appearances or calls except for a pair at Kamgaon in November.

114. *Centropus sinensis*. Crow Pheasant.

Common resident in the plains. During the hot months of April and May they spent much time stalking in pairs about muddy edges of tanks. On September 19th at Akot a bird was sitting on its nest.

115. *Psittacula krameri*. Green Parrakeet.

The most common Parrakeet. Mating in February.

116. *Psittacula cyanocephala*. Blossom-headed Parrakeet.

Resident and quite common in wooded parts, though not generally round towns and open country in the plains. Teak and Salai forests are favourite haunts. In pairs in January.

The large Parrakeet must occur but I have not noticed it. A very small Parakeet probably occurs, which I have only caught rapid glimpses of, on one occasion by the road near Ellichpur and at Khatkali in the Melghat.

117. *Strix ocellatum*. Mottled Wood Owl.

At Buldana in a wooded area.

118. *Athene brama*. Spotted Owlet.

Common resident. A pair lived in a tree near our bungalow. They mated in March and brought up the family in a hole in the tree trunk.

Later the whole family continued to live there amusing us with their domestic squabbles. Several other owls occur, including one very large one with conspicuous ears, but I was not able to identify them.

119. *Sarcogyps calvus*. King Vulture.

Frequent. A party of four on a roadside carcass and often seen in pairs.

120. *Pseudogyps bengalensis*. White-backed Vulture.

The most common Vulture.

121. *Gyps fulvus*. Griffon Vulture.

Quite often with White-backed Vultures.

122. *Neophron percnopterus*. Scavenger Vulture.

Too common.

123. *Butastur teesa*. White-eyed Buzzard.

Common. Probably migratory as it was not noticed between April 11th and early September. Often near tanks.

124. *Spilornis cheela*. Crested Serpent Eagle.

An immature bird seen at Chikalda. None in the plains.

125. *Haliastur indus*. Brahminy Kite.

Common plains resident round tanks. Only once seen in the Mēlghāt when two or three were perched on boulders of a forest stream in May.

126. *Milvus migrans*. Common Pariah Kite.

Very common about habitations. Many families reared in March.

127. *Circus æruginosus*. Marsh Harrier.

Rather uncommon. In winter, solitary near tanks or streams.

128. *Circus macrourus*. Pale Harrier.

Common winter visitor. Usually single flying low over cultivation. Latest date April 4th at Basim. Earliest September 10th in the same locality.

129. *Astur badius*. Shikra.

Fairly common.

130. *Falco chicquera*. Red-headed Merlin.

Has only been noticed on a few occasions.

131. *Falco tinnunculus*. Kestrel.

Common in winter. Latest date March 17th. There were several other members of this order which I was unable to identify with any certainty.

132. *Crocopus phœnicopterus*. Common Green Pigeon.

Common resident of the Mēlghāt. In large flocks at Chikalda and Khatkali. Rather lacking in the plains, in May a pair were near a tank in Amraoti District.

133. *Columba livia*. Blue Rock Pigeon.

Common resident round old buildings. A large flock grazing on a fallow field near Ghatang in the Mēlghāt in November.

134. *Streptopelia orientalis*. Rufous Turtle Dove.

Appears to be absent from the plains. November '39 Chikalda, none. March 21st-25th '40 abundant on the plateau and nearby slopes in flocks that fed on the ground and flew up into trees when disturbed, being very shy. It was the most common species of dove at this time. May '40 Chikalda, none. October '40 Chikalda, none.

135. *Streptopelia chinensis*. Spotted Dove.

Common resident, more so in wooded areas, less in open country.

136. *Streptopelia senegalensis*. Little Brown Dove.

Common resident of open country.

137. *Streptopelia risoria*. Indian Ring Dove.

Common resident of open country.

138. *Oenopopelia tranquebarica*. Red Turtle Dove.

The least common of the doves though frequently seen. Seldom noticed during the rains.

139. *Pterocles exustus*. Common Sandgrouse.

Resident in the plains.

140. *Pavo cristatus*. Common Peafowl.

Frequently seen in the early mornings and late evenings in wooded parts.

141. *Gallus sonnerati*. Grey Jungle Fowl.

Common resident of the Mēlghāt. Lantana bushes were the favourite cover. In March the cocks crowed to each other from cover to cover all day long. The Red Jungle Fowl appeared to be absent, but once I thought I saw a cock.

142. *Galloperdix spadicea*. Red Spur Fowl.

Common in the Mēlghāt in March and are probably resident.

**143. *Coturnix coturnix*.
C. coromandelicus.
Perdicula asiatica. } Quails.**

144. *Francolinus pondicerianus*. Grey Partridge.

Common.

145. *Gallinula chloropus*. Water Hen.

Occasionally skulking at the edges of tanks and streams. No White-breasted Water-hen were seen.

146. *Porphyrio poliocephalus*. Purple Coot.

Uncommon. The only occasion seen was on July 9th at Kamgaon tank, a pair on a sand spit fringed by reeds.

147. *Fulica atra*. Common Coot.

Common in flocks in winter on all the tanks. No cranes were seen, though the Sarus Crane appeared common in Nagpur District.

148. *Cursorius coromandellicus*. Indian Courser.

Several times during April solitary birds were sipping water at the edges of Wadali tank Amraoti.

149. *Hydrophasianus chirurgus*. Pheasant-tailed Jacana.

Fairly common resident on weedy patches of tanks. The Bronze-winged Jacana which was very common in Nagpur District did not occur in Berār.

150. *Esacus recurvirostris*. Great Stone Plover.

Uncommon. On January 19th at Karunja tank a solitary bird was wading in shallow water near a mud spit with many small waders. No Stone Curlews.

151. *Lobivanellus indicus*. Red-wattled Lapwing.

Common resident near tanks. In quite large numbers in winter.

152. *Lobipluvya malabarica*. Yellow-wattled Lapwing.

Less common than the Red-wattled. In April and May many pairs on a rough stony area in Amraoti. They must have been breeding.

153. *Charadrius dubius*. Little Ring Plover.

Common about tanks and rivers. Comparatively few were noticed during the hot weather and rains.

154. *Leucopoliis alexandrinus*. Kentish Plover.

A few at Karunja tank during the winter running about the edges with Little Ring Plovers.

155. *Himantopus himantopus*. Black-winged Stilt.

Common in winter. Latest date—about the middle of May at Wadali tank Amraoti. Earliest date October 15th Karunja tank. Between these dates they were seen on one occasion on June 19th when a party of ten were at the edges of Kamgaon tank.

156. *Tringa hypoleucus*. Common Sandpiper.

Common in winter. Usually solitary at the edges of any kind of water. Latest date May 2nd a pair that had practically lived at a tiny water scoop till then had disappeared. Earliest date September 10th.

157. *Tringa ochropus*. Green Sandpiper.

Common winter visitor.

158. *Tringa glareola*. Wood Sandpiper.

Common in flocks at the edges of tanks. Latest date April 1st.

159. *Erolia minuta*. Little Stint.

In flocks at the edges of tanks in winter. I may have confused these last two Sandpipers.

160. *Tringa stagnatilis*. Marsh Sandpiper.

At Karunja tank in January.

161. *Tringa nebularia*. Green Shank.

At Kamgaon tank and one or two other tanks in winter. The Red Shank was not noticeable though it was probably overlooked.

162. *Capella gallinago*. Common Snipe.

Not very plentiful. Latest date March 27th. On January 5th at Karunja tank, three birds were wading in water breast deep. They all progressed in the same direction plunging in the long bill downwards with a curious bobbing movement. My knowledge of the different snipe being very lacking these may have been some other kind.

163. *Sterna aurantia*. Common River Tern.

Some at Karunja and Kamgaon tanks.

164. *Sterna melanogaster*. Black-bellied Tern.

Only one seen at Karunja tank. No Terns were noticed during the hot weather or rains.

165. *Phalacrocorax niger*. Little Cormorant.

Fairly common in all tanks during the winter and hot weather. Usually perched with the Common Cormorant.

166. *Phalacrocorax carbo*. Common Cormorant.

More common than the Little Cormorant. Perched on submerged stumps and trees. Till the first week in June they were in full force at Kamgaon tank, the evening flights inland were always punctual. With the break of the rains the large majority seemed to disappear from all tanks very few remaining. No nesting colonies on submerged trees were seen. They gradually returned to the tanks from about September 10th.

167. *Anhinga melanogaster*. Indian Darter.

Common on tanks. Very few during the rains.

168. *Threskiornis melanocephalus*. White Ibis.

A small party at Karunja tank made their headquarters on a mud spit with storks and herons during January and February. At Kamgaon tank a party was established on one area at the edge of the tank in May and June. By July none were to be seen by any of the tanks. The Black Ibis appeared to be absent.

169. *Platalea leucorodia*. Spoon-bill.

A small party were at Karunja tank on several occasions in January. They had not been there before and were not noticed anywhere after.

170. *Dissoura episcopus*. White-necked Stork.

A resident, often at the margins of tanks in open cultivated country or soaring high.

171. *Ardea cinerea*. Common Heron.

Resident, but very few seen during the rains. In May two pairs at Wadali tank Amraoti spent much of their time in trees further inland. In winter they were common at all the tanks. A very large edition of the Common Heron was at Karunja tank in December and January.

172. *Ardea purpurea*. Purple Heron.

At most of the tanks this bird was not a skulker, and was usually seen standing in the most open parts as other herons. Only once at Shegaon tank was it flushed from reeds. At Wadali tank Amraoti a solitary bird was resident from December till the beginning of the rains. None were seen during the rains.

173. *Egretta arzetia*. Little Egret.

Always solitary about streams, rivers and pools.

174. *Bubulcus ibis*. Cattle Egret.

Very common in winter and the hot weather. In April they were in close attendance on villagers dragging the muddy remains of tanks for fish and almost having to be pushed out of the way. About May they assumed breeding plumage. At the end of June when the rains set in they disappeared from all water areas. On September 27th at Kamgaon tank a small party were making for their usual corner of the tank. By October they were back everywhere in full force.

175. *Egretta alba*. Large Egret.

Fairly common, always with cattle egrets at tanks. They also disappeared during the rains.

176. *Ardeola grayii*. Paddy Bird.

Common.

177. *Nycticorax nycticorax*. Night Heron.

Occasionally seen flying from bushes overhanging rivers in daylight.

178. *Butorides striatus*. Little Green Heron.

Sometimes noticed by streams.

179. *Nettapus coromandelianus*. Cotton Teal.

A resident in small numbers.

180. *Dendrocygna javanica*. Whistling Teal.

Not very common and none were observed during the hot weather.

181. *Anas platyrhynchos*. Mallard.

Winter visitor in small numbers. The majority were seen at a tank near Chandur Bazar.

182. *Anas pœcilorhynchos*. Indian Spotbill.

A few at Karunja tank in winter. None noted as resident.

183. *Anas strepera*. Gadwall.

Common winter visitor to most of the tanks.

184. *Anas penelope*. Widgeon.

Winter visitor. Noted on Karunja tank only in January '40. In November '40 they were on most of the tanks, especially Kamgaon and Shegaon as one of the commonest duck.

185. *Anas crecca*. Common Teal.

Common winter visitor.

186. *Anas querquedula*. Garganey.

Common winter visitor seen in small numbers till about March when there appeared to be a large increase just when other ducks were disappearing. A large flock appeared at Wadali tank Amraoti on March 11th and remained till May 2nd. Till this date large flocks were seen on nearly all tanks.

187. *Dafila acuta*. Pintail.

Winter visitor in small numbers. In March and early April. At Wadali tank Amraoti two pairs kept to themselves. On April 21st a solitary male remained and was not seen again. On June 19th at Kamgaon tank a pair was with some Cotton Teal and was seen again a fortnight later.

188. *Spatula clypeata*. Shoveller.

Winter visitor. In small scattered numbers on Karunja tank during winter. In March and April the numbers greatly increased; quite large flocks appearing on most of the tanks especially Shegaon and Lonar; they were then in breeding plumage. Latest date April 21st; a solitary bird, the remains of a small flock at Wadali tank Amraoti.

189. *Aythya ferina*. Pochard.

Winter visitor in small numbers to most of the tanks, on January 28th at Chandur Bazar tank was the largest number noted.

190. *Netta rufina*. Red-crested Pochard.

Uncommon winter visitor, a few pairs were at Karunja tank in October '40.

191. *Aythya rufa*. White-eyed Pochard.

Winter visitor. In November '40 there were many on the Chandur Bazar tank.

192. *Aythya fuligula*. Tufted Duck.

The only occasion noted was on April 24th a solitary male on Wadali tank. It remained in the middle of the tank well away from a flock of Gargany that were the only other duck present. May 1st was the latest date it was seen.

193. *Podiceps ruficollis*. Little Grebe.

Common resident. In May with the departure of duck they became much more noticeable, and large flocks collected on most patches of water.

THE TERNS AND EDIBLE-NEST SWIFTS AT VENGURLA, WEST COAST, INDIA.

BY

HUMAYUN ABDULALI.

The reports of Mr. Whistler and Dr. Ticehurst on the fragments of eggs and skins picked up at random at the Vengurla Rocks (*J.B.N.H.S.* xli., p. 663) indicated possibilities for further field work and I had been thinking of another trip ever since. While at Bharatpore with Mr. Salim Ali last year, we planned to go down together and have another look around. Mr. McCann was then recruited and when we left, we were accompanied by Fr. Santapau of St. Xavier's College, and Prof. Bharucha of the Royal Institute of Science.

In February 1938, we had got to Malwan by ferry, and considering that few people had motored through the Konkan, we decided this time to run down to Malwan by car. The maps indicated a run of 350 odd miles and we hoped to do this distance in about 12 hours of driving.

We left Bombay late on the night of Tuesday the 4th March, in two Morris eights, packed with the paraphernalia necessary to eat and sleep anywhere. The road to Panvel was bad and dusty, and buses and trucks were still running. At one in the morning we pulled up at the Inspection Bungalow, on the banks of the Patalganga, and slept till seven.

We had expected to reach Malwan by Wednesday evening, and had asked the Fisheries Department to arrange for the boats on Thursday morning. (I might here acknowledge the assistance rendered by the Fisheries Department, and warn future prospective visitors against the chances of ever reaching the rocks without official co-operation and bandobast.) The road continued to be bad and dusty, and the journey was uneventful, except for one burst hosepipe that drained the water from the tank. The front half of the car heated abnormally and the radiator grill was loosened in its fastenings. An extraordinary rattle ensued and it was quite a time before we located the source of the trouble. McCann now rolled up his sleeves, and proceeded to patch up the tube with what few spares we had, but still the water had to be refilled every half hour. An odd puncture or two added to the interest. The road winds tortuously over innumerable ghatlets and makes it impossible to travel at any speed. Most forests have been chopped down and the hills are either covered with scrub, or bare except for scattered and much pollarded trees, mostly *Terminalia tomentosa*. The local cultivators cut, stack and burn the foliage as the most easily available fertilizer. This deplorable practice must of course be controlled and discouraged, or we are to see the end of our trees and forests in this area.

In the Kolaba District we saw several large flocks of the migrant Red-rumped Swallow (*Hirundo daurica nipalensis*?). Tree pipits (*Anthus trivialis* subsp. *harringtoni* or *trivialis*) were common in small parties, all along the road. Near Viral, Salim observed *Lanius cristatus* (probably the typical form well known in the south but unobserved from Bombay). We reached Chiplun, late in the afternoon and spent an hour replacing the damaged hosepipe and drinking sugar-cane juice. Further south, Cliff Swallows (*Hirundo fluvicola*) were seen on the ghats, and later in the evening a loose flock of pied horn-bills some 25 to 30 birds, flew across the road from one patch of forest to another. Close on midnight, we stopped near Hathkambe. Another night was slept on the road under the banyans, still a long way from Malwan.

We started on Thursday morning determined to get to Malwan non-stop, and to avoid another meal of bully beef and sardines. It is extraordinary how soon tins pall on one! In broad daylight, we chased a mangy hyaena along a ghat road for a couple of hundred yards, and except for an odd shrew, a stray hare and an occasional jackal in the headlights, we saw no other mammals on the trip.

We reached Malwan at noon—a good 18 hours behind scheduled time. Mr. Kalyani of the Fisheries Department, who was looking after us, had almost given us up for lost, and was meditating wiring Bombay, when we arrived. We camped at a rest house on the beach, and our immediate concern was a tinless meal.

The wind was against us, and it was useless attempting the rocks in the afternoon. We sailed out to Karup Kaura (Pigeon Rock) a rock-islet a couple of miles north. It is a long straggly islet with pinnacle-like masses at both ends. Every bit of the little soil available was covered in wild profusion by *Derris* sp., *Chlerodendron inerme*, *Salvadora persica* and a few other maritime species.

In spite of the name, there was no trace of pigeons, and the only birds seen were a pair of grey herons, an osprey, a reef egret and a solitary common sandpiper. Several small parties of gulls and terns were seen flying south apparently to a common roosting place. McCann nosing round the crevices in the pinnacle, dislodged a couple of small bats. One shot proved to be *Tadarida trigata*, Dobson's wrinkled-lipped bat. A sand spit on the islet was littered with the remains of a large sea-urchin.

We left for the Vengurla Rocks late on Friday morning, prepared to camp the night on the rocks. On a semi-submerged reef, close to the shore, were flocks of the Large Crested Tern (*Sterna bergii*) which refused to get collected. The journey towards the Rocks was slow and hot. An occasional gull (*Larus ridibundus* or *brunniceps*) visited the boat, and settled nearby, apparently expecting something to eat. Several large turtles basking at the surface, and a few dolphins were noted. We landed at one of the smaller outlying islands, and pottered about for a while. The rock was bare to the monsoon, but under the shelter of the larger rocks were remains of the smaller terns and their eggs. The highest rock was plastered white, apparently the

regular outpost of a peregrine, the lower rocks being strewn with the feathers of pigeons. There were also numerous skeletons of sea-snakes (*Distira* sp?) the remnants of a sea-eagle's meal. The shallow rock pools along the shore line were intriguing. Small multi-coloured fish darted in and out. Large sea-slugs (*Holothuria atra* Jaeger) were common and one picked up disgorged all its insides, and a tangled mass of silky threads, which peculiar and weird mode of defence gives it the name of silk-spinner. A mass of sponge *Hicinia fusca* clung to a corner and sea-weeds of sorts were plentiful all around.

Of the three large rocks, the one with the old light-house was out at sea, and the boatmen ruled it out as inaccessible. The light-house rock is a prohibited area, and we landed on the largest island which I had previously visited. There was the same dense growth of grass (*Ischaemum* sp.) with some extraordinarily tall *Celosia*.

McCann who was in charge of all the troublesome items on the trip, and who identified most of the miscellaneous material, built up a kitchen and we rested an hour or two trying to pitch camp on the rocks. The whole place appeared to be an interminable number of shelves, except that they were anything but flat—as we were to find out later in the night.

An osprey and a white-bellied sea-eagle were seen. There were again numerous remains of terns and their eggs lying all over the island, and a fairly representative collection was made. Salim Ali compared the fragments with specimens in the Society's collection and the following is all from his notes. Several entire wings were obtained together with a few beaks.

A series of eight large eggs averaging 60.3×43 mm. (max. 69×43 and 63×45 mm.; min. 57×42.5 and 58×42 mm.) appear to be those of the Large Crested Tern (*Sterna bergii*). This merely confirms the previous record but the absence of specimens prevents the subspecific identification of the birds.

The smaller terns were of two distinct types—brown-winged and grey-winged.

Four brown wings, measured 242, 240 and 237 mm. (2). One of the last was an almost complete skeleton and the beak measured 37 mm. These appear to agree with one form or another of *Sterna anaetheta*, which was recorded here by Hume in 1875. Incidentally, this is quoted under *S. a. antartica* in the new *Fauna* but omitted from *Nidification*.

Two brown wings, however, measure 270 and 294 mm., and apparently belong to the Sooty Tern (*S. fuscata*). This is a new record for Vengurla, the nearest hitherto known breeding place is in the Laccadives. A beak measuring 40 mm. may support this identification.

Two grey wings measuring 212 and 217 mm. are too small for *S. repressa*, the White-Checked Tern, but agree with *Sterna dougalli* (*Fauna* 210-226 mm.). The colour pattern of the primaries also agrees with the description in the *Fauna*. In the Society's collection are four eggs labelled "*Sterna dougalli* Vengurla Rocks", by W. F. Sinclair, and seven by N. F. Jardine. Remains obtained by us agreed with them. It will be recalled that a

series in the British Museum labelled *dougalli* were obtained by Davidson from the same rocks. The wings in any case appear to confirm the eggs.

Other eggs obtained agreed with those of *S. repressa*, which merely confirms the report on my previous lot of eggs and wings.

This rock island during the nesting season must be an extraordinarily mixed colony. To the breeding records of *Sterna bergii*, *anaetheta* and *repressa* are now added *dougalli* and *fuscata*. Though the island is relatively small, we may quite possibly have missed other fragments. It is difficult to discriminate in a mass of bleached and broken eggs and skeletal remains.

Most of our time on the island was taken up in the investigation of the cave of the Edible-nest swift (*Collacolia fuciphaga unicolor*). It will be recalled that the cave runs southward into the island for about a hundred yards. Its floor is almost on a level with the sea, but this approach is inaccessible to a boat. The 65 ft. walls run parallel some 20 ft. apart. On the innermost side, the roof has fallen in, forming a skylight. This appeared to have grown larger than it was three years ago.

A descent through the sheer skylight was forbidding, and we reached the entrance at sea-level, climbing down the cliff-face with the aid of ropes. A few pigeons flew out, but there was no sign of the swifts. The eastern wall was pock-marked with nests apparently most numerous in the darkest corners. The swifts, we knew, would come in later and we pottered about the cave. In February, 1938, I had found large scorpions (*Palamnaeus* sp.) and *Riopa guentheri* very common. This time the scorpions were missing and the skink much scarcer. The gecko (*Hemidactylus brookei*) which was only guessed at from the fragments of an egg last time, was exceedingly common. Even island populations, apparently balanced and stable, appear to fluctuate and vary considerably. Many cockroaches (*Periplaneta americana*) were present. A few centipedes (*Scolopendra* sp.) were observed. We also examined another smaller cave running into the eastern side of the island, but saw no trace of animal life, except for a few pigeons. The tide came right into this cave and there was a sandspit at its innermost end.

The nests of the swifts were again swarming with bed bugs, and I might draw attention to a note by A. Kunhikannan, Asst. Entomologist at Bangalore, recording bugs being found on the Common Yellow Bat (*Scotophilus kuhli*) taken from holes in coconut palms near Tellicherry, (*J.B.N.H.S.*, xxi, p. 1342). Is it possible to attach any significance to the fact that though in close contact with them for a considerable period I nor anybody else was bitten by these bugs? In the same volume (p. 1091), Dodsworth records beetles (*Dermestridae*) *Anthrenus fasciatus* and *Attagenus* sp. obtained from nests of the common swifts. It is there suggested that they feed on old feathers and similar refuse.

McCann had brought a few flash light bulbs and an attempt was made to photograph the nests. Light coming in through the skylight however, confused matters and the results were disappointing. Fr. Santapau obtained one picture in which some 250 nests are visible. We should have waited until it was quite dark, as the

birds then started swarming in through the main entrance. We could see them clinging to the rocks and to their nests, by torch-light, but our flash bulbs were then exhausted. No birds were seen entering through the skylight.

The whole cave had a musky, batty smell, and the swifts also twittered intermittently like a swarm of bats. Clinging in closely packed groups to the cliff and their nests, they looked extraordinarily like bats. (In *Nidification*, v. iii, p. 466, Stewart refers to nests of spinetails (*Indicapus*) in hollow trees in Travancore and states the native could tell their smell from that of bats). No attempt was made to sit in or across the nest. The birds cling to the rim of the shallow saucer-like nest with their breasts to the cliff, and there was often another bird clinging under the nest. We caught several roosting birds by hand, and large numbers could be collected with a butterfly net.

A very rough estimate indicated 5,000 birds and over a thousand nests, in all stages of construction. Are the same nests used more than once? Many of them appeared to have been repaired (replastered with saliva) and fresher than any I had noted in February 1938. In patches the nests were within two and three inches of one another. On the way out, I was hauled up by a rope through the skylight, and looked into at least a hundred nests. They were all empty. While dangling from the rope, I met a small mouse, face to face, but was unable to secure it.

The salivary glands of both males and females obtained were enlarged, but the only noticeable development in the organs was a male with testes 3×2 mm.

Their stomachs (4) were packed with insect remains (identified at the Indian Museum, Calcutta), and mango-hoppers (*Jassids*) of two species (*Ideocerus nivecsparsus* and *atkinsoni*) comprised about 80 per cent of the total contents. A small pulse beetle (*Bruchus theobromae*) was also prominent and may have amounted to 10 per cent. There were remains and traces of HEMIPTERA, *Lygaedae* (*Pamera pallicornis*), and *Pentatomidae* (*Cydnius varians*—geranium bugs), COLEOPTERA, *Carabidae*, *Bostrychidae* (*Sinoxylon anale*—a wood-borer). *Nitidulidae* (Scavenger beetles) *Elateridae* (*Acolus brachmana*—click beetle), *Coccinellidae* (lady bird beetles), *Staphylinidae* (rove beetles), *Chrysomelidae* (*Chaetocnema* sp. probably *basalis*—flea beetle of rice), ODONATA, *Zygoptera* (remains of two small dragon flies), HYMENOPTERA, *Chrysidae* (Cuckoo wasps) *Formicidae* (*Myrmicinae*) DIPTERA (remains of flies), TRICHOPTERA (traces of caddis flies).

We visited the cave again after midnight, and the birds were still awake, struggling for possession of the nests, and other roosting places, twittering all the time. We watched them for a while and then returned to camp. At dawn all the birds had left. I might mention that Barnes in 'The Birds of the Bombay Presidency', states that 'the edible-nest swiftlet is a hot weather visitant to the Vengurla Rocks, where it breeds'. I do not know on what evidence the bird is said to be a migrant, though it would be interesting to ascertain how it obtains its food in stormy weather. There was hardly a foot of level ground to stretch ourselves out,

and when we got up in the morning, we were all agreed that we had discovered the hardest rocks in the world!

We sailed again at 8 a.m., expecting to reach Malwan by noon, as some of us had to be in Bombay on Monday morning. This would have left us thirty-six hours for the return drive. The wind, however, turned against us, and at noon we were hugging the shore but nowhere nearer Malwan. Finally we landed at Mobar, a Government fishing yard some nine miles south of Malwan. The heat was terrific. A flight of sixty-five to sixty-eight flamingos, heading north far out at sea was observed, and a large mixed flock of migrant gulls, including the great Black-headed Gull on a sandspit at Mobar. A few Caspian terns were also seen. *Vitex trifolia* was abundantly in bloom along this shore.

There is no road between Mobar and Malwan, and Salim and I bicycled nine miles along the sea-shore, to get our cars for the luggage and the other stranded passengers. The incoming tide, however, held up the cars for a considerable period, and it was well past midnight, when we reached Malwan.

We left Malwan on Sunday morning, having decided to avoid the Konkan and return through the Deccan. Some magnificent *Bombax Ceiba* were in flower on the Kholapur Ghats. The Pied Bush-Chat (*Saxicola caprata atrata*) was common and doubtless preparing to breed. There was little else of interest on the road. We lunched at Kholapur and had tea at Satara. The two cars lost each other in Poona, and dinner was delayed till ten. We decided to sleep the night at Khandalla and run into Bombay early on Monday morning. The small cars had behaved magnificently but a continued attempt to average forty miles proved too much for one of them. A few miles out of Thana, the engine-mounting gave way, and the engine bumped into the radiator tearing down the hose-pipe again, as also the fan-belt and other incidentals. We towed this car into Bombay.

At Thana there was an amusing interlude. The excise police inquired what had happened, and I volunteered the information that the whole engine had dropped off. As an after-thought, somebody suggested that they open the bonnet and have a look. Nobody did so, but the news spread rapidly, and I am sure I could produce a lot of police and other witnesses to testify that I lost my engine on the Ghats!

I might here acknowledge with gratitude on behalf of all the members of the party, the help and co-operation of Dr. S. B. Setna and Mr. Kalyani, without whose assistance the trip might never have materialised.

The trip was strenuous and exacting. Much more time and energy were expended in getting to Malwan and back, than on the rocks. The ornithological results, however, I think, were satisfactory except for the photographs of the swifts. To get more reliable information, one must make a landing when the terns are breeding during the monsoon, an almost hopeless proposition. The monsoon has hardly broken as yet, but the papers this morning (28-5-41) bore the laconic news that fifteen vessels had sunk at Malwan, though no lives were lost!

FISH OF POONA.

PART III.

(Continued from page 225 of this volume).

Biological Observations on Certain Species.

BY

CAPT. A. G. L. FRASER, I.M.D.

This part deals with observations made in the field on the ecology and bionomics of certain species. The notes were taken under the local names of fishes and I am indebted to Dr. S. L. Hora and Mr. K. S. Misra for supplying me with the corresponding scientific names. The notes have been revised by Dr. Hora and for this my sincere thanks are due to him.

Notopterus notopterus (Pallas).—This species is locally known as CHALUT and is to be found throughout the year everywhere in the river, canal and lakes.

Chela spp.—The Chilwa fish, locally called AMBLI or AMBLEE and by several other names, is also present at all times of the year. In certain sections where the current is strong it is the dominant species. They move about in shoals generally in midstream. The commonest form is *Chela clupeioides* (Bl.), while the other two species, *C. boopis* Day and *C. phulo* Ham., are less common, but all of them prefer the same type of habitat. Two specimens of *C. boopis* were caught near the dam at Lake Fife where there is a current of water rushing through the sluices into the Right Bank Canal. The presence of the species in the Lake suggests that it can also live in still water conditions of the lake.

Danio aequipinnatus (McClelland).—This species, locally known as THOOK CHATEE, is in evidence everywhere, but appears to be more numerous in the canal and lakes. Those taken from the canal were larger and better nourished than others of its kind found in the river and lakes.

Rasbora daniconius (Ham.).—The RANJANNAH of the local people is found associated with THOOK CHATEE [*Danio aequipinnatus* (McClell.)], but is less numerous.

Barbus spp.—There are several species of *Barbus* in the collection and among the larger ones some are with two barbels and some with four. The KHADREE, *Barbus* (*Puntius*) *jerdoni* Day shows three colour varieties in respect of the fins, namely, all white, all red and all yellow. They are present in the river, canal and lakes. The form with the white fins is more numerous. The BARSA [*Barbus* (*Tor*) *khudree* Sykes], with two pairs of barbels, is most often found

in the localities where ground species like the MALLAH [*Garra mullya* (Sykes)] and the Labeos abound. It shows a preference for sections of the river where there are beds of rock and the currents are moderately strong. The DEBRIE [*Barbus (Puntius) ticto* Ham.] was found to be very common in the section of the Mutha-Mula river near the Infectious Hospital and in the Pashan Lake, but in other parts of the river and in the canal and lakes it was not so numerous.

Garra mullya (Sykes).—The MALLAH, MALLIA OR NAKHTA MALLIA is found abundantly in the rocky sections of the river and canal.

Schizatorhynchus (Nukta) nukta (Sykes).—In my wanderings here I have often been asked by fishermen whether I had ever seen a fish locally known to them as *Dhotowandee*, so called by them because of a physical peculiarity above the mouth proper which gives it the presentation that it is possessed of two mouths. In actual fact there is a slit in between the two nasal apertures which are placed in it at each end. The upper lip of this depression, midway, shows a protuberance. The division is patent and does not communicate with the mouth proper which is placed below it. The whole of this depression was tinged with red, when the fish was freshly caught. It is because of this peculiarity, giving it the semblance of a second mouth, that fishermen, believe that it really has two mouths. According to fishermen this species is rarely if ever caught and the man who worked with me was reluctant to surrender the specimen when he discovered it was a DHOTOWANDEE. The belief current amongst fishermen is that the fish brings luck to the household of the man who is fortunate enough to net it. The fact remains that there is one specimen of this rarity in the collection. It was caught $4\frac{1}{2}$ miles east of Fitzgerald bridge near Kharadigaon village on 10th June 1937.

Nemachilichthys ruppelli (Sykes).—The SOONDEAH GARAH has a pretty colour presentation in that it shows a scarlet blotch dorsally on the head. All the fins are coloured scarlet, except the caudal, which has a band of scarlet placed nearer to the body attachment. The body is darkly discoloured dorsally and mottled laterally and the belly is pale. The word SOONDEAH (needle-like) signifies its physical character and refers to its somewhat attenuated form. It should be noted that the word GARAH represents the group name for all loaches (Cobitidae), which are not so common in these waters.

Bagarius bagarius (Ham.).—Though several specimens of the GOOCH were caught in August, 1936, none were sent to Dr. Hora on account of their large size. It would seem that this species disappears altogether after the monsoon. It is significant that none have been caught during the period of the survey from 15-9-1936 to 10-6-1937. Specimens of *Wallagonia attu* (Bl.), locally known as PAHREE, were also not sent to Dr. Hora though several were secured during August, 1936,—one was a particularly large example weighing 12 lbs.

Silonopangasius childrenii (Sykes).—Local name SEELUNDH: This is another species which disappears after the monsoon. Four

specimens in the collection were caught on 4-10-1936; after which no examples of this species were caught. During August, 1936, several large specimens were secured but they were not sent to Dr. Hora.

Xenentodon cancila (Ham.).—The DENGWAH has numerous teeth and the mouth parts are extended forward for one and a half inches in the form of a beak. The body is rounded like the eel but the tail is diphycercal. They were observed to move about in pairs swimming just below the surface film with the beak showing above the water line. A very young specimen, one and a half inches long, was seen in a shallow stagnant pocket about 8 inches deep in the section of the river near the Holkar Bridge on 28-2-1937. The young fry remained stationary lying flat with the surface film and moved only when disturbed by my attempts to catch it with a scoop net. A large amount of algae was present into which it disappeared. When all was quite again it reappeared and resumed its stationary position at the surface. The adults were recovered from the river and canal and show a preference for strong currents. None were caught in the lakes.

Ophicephalus spp.—The species locally called DAKHOO is identical with *Ophicephalus gachua* Ham. It does not appear to be common in these waters. As regards the fish called MURRAL, there are two species. One of these has a well defined ocellus superiorly placed on the caudal fin and apparently is *Ophicephalus marulius* Ham. A single specimen, which was black in colour, showed no ocellus on the caudal fin. MURRALS are easily hooked by Indian anglers who use hand lines with cockroach as bait. They are present in fair numbers and were recovered from weed grown sections where the depth was 2-3 feet and the current weak. Some large examples were secured during August, 1936, and sent to Dr. Hora.

Ambassis ranga (Ham.).—This species is locally known as CHANDWAH. It is the same transparent fish called BING by Bhil fishermen. As in the Deolali waterways, it is found here also midstream in strong currents and in deep water. It is singularly absent in the four miles stretch of rocky channels and pools below Fitzgerald Bridge during the dry season, when the currents are weak and the pools are not deep.

ON THE BIRDS OF THE KAREN HILLS AND KARENNI
FOUND OVER 3,000 FEET.

BY

H. C. SMITH, M.B.O.U., P. F. GARTHWAITE, AND

B. E. SMYTHIES,

Burma Forest Service,

assisted by

the late Dr. C. B. TICEHURST, M.A., M.R.C.S., M.B.O.U., etc.

Our preliminary reconnaissance of the Nattaung area, the results of which were published in Vol. xli No. 3 (June 1940) of this journal, proved so interesting that a second and longer visit was paid in 1940 (Smythies from 26 March to 23 April, Smith and Garthwaite 8-17 April). A number of visits were also paid to Thandaung: 23-25 September 1939 (Smith and Smythies), 15 and 22 October 1939, 1-3 November 1939, 20-23 March 1940, 24 April to 12 May 1940 (Smythies), 28 April to 9 May and 29 August to 1 September 1941 (Smith), 6-12 October 1941 (Smith and Smythies).

The specimens collected in 1939 and 1940 were sent home to Dr. Ticehurst and the identifications verified or corrected by him; he also, and it must have been shortly before his death, corrected this paper for publication, and supplied many 'previous records', including all those not followed by a name, from papers not accessible to us; owing to the war he was unable, as was his wont, to take specimens to the British Museum for comparison, and to write systematic notes on the results of his findings. His death, besides being a great loss to science, is a sad blow to those of us who had the pleasure of working for him and benefiting by his unique knowledge of the birds of Burma and by his constant encouragement and enthusiasm.

Scope of the paper. No connected account of the birds of the Karen Hills and Karenni has ever been written, and this paper is an attempt to supply the deficiency. To avoid repetition specimens and field notes recorded in our previous paper have been omitted, and the two papers are intended to be read together. The writers have had no opportunity of studying the birds of the valleys of the interior, e.g., the Salween valley, and all their collecting has been confined to the higher hills over 3,000 feet, to which the scope of this paper has therefore to be restricted. All previous records have been collated and some birds likely to occur, but not definitely recorded as yet, have been included in square brackets. In volumes v and vi of the *F.B.I.* there are numbers of birds that might conceivably occur, especially among the *Falconidae*, but there is no object in listing them all and as far as these two volumes are concerned only birds actually recorded have been included.

Boundaries of the Area. See map included with our previous paper (the scale of which is actually 1"=8 miles and not 1"=4 miles

as printed in error). The Karen Hills and Karenni extend some distance north, east and south of the area shown on the map. Karenni extends east of the Salween, but no one has ever collected there and for this paper the eastern boundary is taken as the Salween river; the area thus falls within the rectangle defined by Latitudes $16^{\circ} 30'$ N. and $20^{\circ} 00'$ N., and Longitudes $96^{\circ} 30'$ E. and $98^{\circ} 00'$ E., the actual boundaries being the northern boundary of the Toungoo district and Karenni on the north, the Salween river on the east, the sea on the south and the Sittang river on the west, excluding the valleys (land under 3,000 feet).

Description of the Area. The country is mountainous throughout, the average height of the ridges being 3,000 to 4,000 feet with higher peaks to 8,607 feet. Over vast areas the original forest has long since been cleared by the Karens, who practise shifting cultivation (*taungya*) and the ground is covered by regrowth (*ponzo*), which is cut and burnt every 10-20 years. Only on the higher hills does much of the original forest remain, and the significance of Nattaung is that, in addition to being the highest mountain in the area, it is covered by what is probably the largest block of natural forest still remaining.

Collecting was done round two centres, Nattaung (fully described in our previous paper) and Thandaung.

On Nattaung we pitched our camp near mile 86 of the Mawchi road, and the headwaters of the Kolo and Kemapyu streams were well worked; a camp was twice taken to the top of Sosiko (c. 7,500 feet). The Wrens' Paradise, which is referred to occasionally, is a small stream rising near the summit and flowing through marshy ground for nearly a mile, covered over by a dense growth of moss, ferns, creepers and some cane brake, the whole forming a habitat much appreciated by Wrens, Shortwings, Thrushes, Woodcock, Hill Partridges, etc.

Thandaung is a small hill station, consisting chiefly of a tea estate, the highest point being a hill known as Thandaung-gyi 4,832 feet. A forest reserve contains a block of evergreen forest with dense bamboo thickets, and the tea estate attracts birds that like open conditions, so that Thandaung is an excellent centre. It is 40 miles in an air line N.-W. of Nattaung, which is visible in clear weather. The pine forests appear to be confined to the Salween drainage and there are none near Thandaung.

Mt. Byingye (Lat. $20^{\circ} 00'$ N., Long. $96^{\circ} 20'$ E.) is referred to once or twice and is, like Thandaung, a mountain on the scarp of the Shan plateau rising from the Sittang valley and is on the borders of the Yamethin district and the Southern Shan States about 60-70 miles north of Thandaung (it is visible from parts of the Leiktho path). Kalaw is a hill station north of Byingye.

Much remains to be done in the area, and as a guide to future workers the following list is given of species that are wanted for systematic work; in each case a good series in fresh plumage is needed:

- Dendrocitta formosae*, to determine whether *assimilis* is a valid race.
Alcippe poiocephala karenni.
Criniger flaveolus burmanicus.

Molpastes cafer nigripileus, see text.

Pericrocotus solaris, to determine the race.

Acrocephalus agricola stевensі, to determine the race.

Tchitrea paradisi, to determine the race.

Passer rutilans, to determine the race.

Zosterops palpebrosa, to determine whether *Z. a. mesoxantha* is a valid race.

Attention should be paid to the Hawks, especially the Buzzards of the Thandaung tea estate, and an eye should always be kept open for Frogmouths.

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SYSTEMATIC LIST.

8. *Corvus macrorhynchus* subsp. Jungle Crow.

Previous records.—Nothing definite.

Specimens.—None.

Noted.—Common near Karen villages and isolated huts, at elevations up to 6,000 feet. It is the common Crow of Thandaung.

[13. *Corvus splendens insolens*. Burmese House Crow.

Cook recorded this species at Thandaung, 'round dwellings and camping grounds only', but we have seen none.]

21. *Urocissa erythrorhyncha magnirostris*. Burmese Red-billed Blue Magpie.

Previous records.—Wardlaw Ramsay found it very common in the Karenni foothills.

Specimens.—None.

Noted.—A pair was seen on the Kolo stream (Nattaung) at 3,500 feet in a taungya; it is evidently scarce above 3,000 feet.

24. *Cissa chinensis chinensis*. Green Magpie.

Previous records.—Karen Hills (Wardlaw Ramsay).

Specimens.—None.

Noted.—A party was seen at 6,000 feet on the Kolo stream (Nattaung); it is not uncommon at Thandaung, but restricted to evergreen and wet thickets. Solitary birds are usually seen, but parties of half a dozen are also met with. It has a harsh raucous swearing alarm-note, usually ending with a higher note.

29. *Dendrocitta vagabunda* subsp. Burmese Treepie.

Previous records.—Nothing definite.

Specimens.—None.

Noted.—A few birds were seen in Thandaung at the end of the rains, but it was absent in the hot weather and was not seen on Nattaung.

33. *Dendrocitta formosæ* subsp. Burmese Hill Treepie.

Previous records.—Karenni (Wardlaw Ramsay).

Specimens.—Nattaung 1♂; Thandaung 1♂, 1♀.

Noted.—Common round Thandaung, rather less so on Nattaung.

[36. *Crypsirhina temia*. Black Racket-tailed Magpie.

Oates writes 'East of the Sittang, among the hills, it appears to be rare till Pahnoun (=Papun) is reached. From this place to Mergui it occurs . . . in greater or less abundance.' We have only seen it by the Sittang near Toungoo, and it may be confined to low elevations.]

40. *Garrulus leucotis leucotis*. Burmese Jay.

Previous records.—Karen Hills (Wardlaw Ramsay).

Specimens.—Nattaung 1 ♂.

Noted.—Several pairs were seen on Nattaung in the pine forests up to 5,500 feet. Not seen at Thandaung.

57. *Parus major commixtus*. Burmese Great Tit.

Previous records.—Karenni (Wardlaw Ramsay).

Specimens.—Nattaung 1 ♂.

Noted.—A few pairs were seen on Nattaung in the more open parts of the forest up to 6,000 feet. Not seen at Thandaung.

74. *Macholophus spilnotus subviridis*. Burmese Black-spotted Yellow Tit.

Previous records.—Karenni 3,500' (Wardlaw Ramsay); Taho (Salvadori).

Specimens.—Nattaung 1 ♂.

Noted.—See our previous paper. It is a common bird in Thandaung.

79. *Aegithaliscus concinnus pulchellus*. Shan Red-headed Tit.

Previous records.—Karenni 3,000' (Wardlaw Ramsay).

Specimens.—Nattaung 1 ♂.

Noted.—All those observed were in parties of about a dozen birds either in long grass and secondary growth or working through the top of the undergrowth and lower canopy in open forest. The black eye-patch and buff crown are diagnostic and members of a party utter very high-pitched call-notes, like the squeak of a bat. It was noticed that about half the birds in each party had black throats and the other half white throats; Dr. Ticehurst writes that he knows of no forms of this species with white throats and that there may have been two species in the parties: more specimens are wanted to clear up the point. The species was not seen at Thandaung.

[87. *Melanochlora sultanea sultanea*. Indian Sultan Tit.

Recorded by Wardlaw Ramsay from Karenni, elevation not stated; it is typically a bird of the foothills and may not ascend over 3,000 feet. We saw none.]

91. *Paradoxornis guttaticollis*. Austen's Parrotbill.

Previous records.—None south of the Shan States.

Specimens.—Nattaung 1 ♂. This record extends the known range of this species southwards.

Noted.—Not seen at Thandaung and probably absent. On Nattaung several parties were seen in *ponzo* and one in open pine forest; they keep to the undergrowth and are partial to a tall reed-like grass that grows in some places. The two black patches, round the eye and on the ear-coverts, separated by a small white patch, and the straw-coloured crown are diagnostic. There is a distinctive harsh peculiar call of 6-7 notes on a monotone.

96. *Suthora poliotis fææ*. Salvadori's Suthora.

Previous records.—Karenni (type locality, Salvadori).

Specimens.—Nattaung 2 ♂.

Noted.—Not seen at Thandaung, and probably absent; for Nattaung see our previous paper. Two parties of a dozen birds were seen this year working through tall grasses at 6,000 feet, one party being associated with *Alcippe* and *Stachyris chrysææ*. The rufous crown, white moustachial streaks and black chin are diagnostic. Delightful little birds and very confiding, but evidently rather scarce.

102. *Suthora ruficeps atrosuperciliaris*. Black-browed Suthora.

Previous records.—None south of Bhamò in North-East Burma.

Specimens.—Thandaung 1 ♂.

Noted.—Not seen on Nattaung. The specimen was one of a pair seen in a bamboo thicket on 24 September, and a party was seen on 3 November associated with *Gampsorhynchus rufulus*, also in a bamboo thicket; Stanford has already commented (*Ibis* 1938, p. 86, and elsewhere) on the habitual association of these two species in bamboo jungle in North-East Burma, and his description of the note as resembling the twang of a guitar is very apt. A single bird was seen on 12 November.

105. *Psittiparus ruficeps bakeri*. Baker's Parrotbill.

Previous records.—Karenni 2,500'-6,000' (Wardlaw Ramsay); near Papun in kaing grass (Davison).

Specimens.—None.

Noted.—We saw none, though on the watch for it, and it must be scarce or local.

106. *Psittiparus gularis gularis*. Grey-headed Parrotbill.

Previous records.—Karenni 5,600' (Wardlaw Ramsay).

Specimens.—Nattaung 1 ♀.

Noted.—Not seen at Thandaung; for Nattaung see our previous paper. This specimen was one of a pair seen in the undergrowth in evergreen; after collecting it the other bird of the pair uttered persistently a loud distinctive call of four notes on a monotone.

112. *Sitta castanea neglecta*. Burmese Nuthatch.

Previous records.—Karen Hills (Walden); Karenni (Wardlaw Ramsay).

Specimens.—None.

Noted.—Seen once at Thandaung. It probably seldom occurs in the higher hills.

115. *Sitta magna*. Giant Nuthatch.

Previous records.—Karenni (Wardlaw Ramsay).

Specimens.—None.

Noted.—See our previous paper. It is not uncommon in the pine forests of Nattaung, but is absent from Thandaung. All those seen were solitary or in pairs. In addition to the harsh corvine trisyllabic call it has a single loud, but not harsh, call-note.

119. *Sitta frontalis corallina*. Velvet-fronted Nuthatch.

Previous records.—Karen Hills and Karenni (Wardlaw Ramsay).

Specimens.—None.

Noted.—Very common in parties on Nattaung and at Thandaung.

122. *Dryonastes chinensis propinquus*. Black-throated Laughing-Thrush.

Previous records.—Papun (Davison).

Specimens.—None.

Noted.—Seen once on Nattaung near a stream at 3,500 feet, and not uncommon round Thandaung, where it was in pairs and probably breeding in May. It is partial to bamboo thickets and also frequents the undergrowth in evergreen. A superb songster.

129. *Garrulax leucolophus belangeri*. Burmese White-crested Laughing-Thrush.

Previous records.—Thandaung (Cook).

Specimens.—Thandaung 1 ♀ (not examined by Dr. Ticehurst).

Noted.—Not seen on Nattaung, but several parties were noted in Thandaung in September, November and May.

133. *Garrulax pectoralis meridionalis*. Burmese Black-gorgeted Laughing-Thrush.

Previous records.—Wardlaw Ramsay found it very common in Karenni, and found nestlings in March. Cook found it breeding at Thandaung.

Specimens.—None.

Noted.—Parties of either this or the next species, or both, were seen in the undergrowth in evergreen, both on Nattaung and at Thandaung.

135. *Garrulax moniliger* subsp. Burmese Necklaced Laughing-Thrush.

Previous records.—Karen Hills (Wardlaw Ramsay). Specimens in the British Museum from Karenni are intermediate between *moniliger* and *fuscata*.

Specimens.—None.

Noted.—See under *Garrulax pectoralis*.

155. *Trochalopteron erythrocephalum ramsayi*. Karenni Red-headed Laughing-Thrush.

Previous records.—Karen Hills and Karenni (Cook, Davison, and Wardlaw Ramsay).

Specimens.—Nattaung 1 ♂, 1 ♀.

Noted.—This bird swarms all over the forests of Nattaung at all elevations. Cook obtained two at Thandaung, but it does not seem to occur there at the present time; it is not easy to overlook in the breeding season and we saw none. One call might be rendered *you would believe it*, with the accent and the highest note on the second syllable of *believe*; the call is often shortened by omitting the first note, and there are other variations.

158. *Trochalopteron ripponi*. Burmese Crimson-winged Laughing-Thrush.

Previous records.—None before 1939.

Specimens.—Nattaung 1 ♀.

Noted.—On Nattaung several parties were observed both in *ponzo* and in the undergrowth in evergreen; the birds converse in low churring notes and they also have a loud musical double call *chi-chweew*, *chi-chweew*. Not seen at Thandaung, and probably absent.

203. *Pomatorhinus schisticeps nuchalis*. Tweeddale's Scimitar Babbler.

Previous records.—Karen Hills and Karenni (Wardlaw Ramsay).

Specimens.—Nattaung 1 ♂, 1 ♀, 1 ♂; Thandaung 1 ♂.

Noted.—This bird is very common in *ponzo* and undergrowth in forest, both on Nattaung and at Thandaung, up to 5,000 feet.

[205. *Pomatorhinus olivaceus* subsp.

In our previous paper we recorded having seen and heard this frequently, but it now seems likely that the birds seen were *P. schisticeps nuchalis*; the two are very hard to differentiate in the field. No-one has so far obtained *olivaceus* in our area, though its occurrence in the Southern Shan States on the one side and Northern Tenasserim on the other suggests that it will be found some day.]

213. *Pomatorhinus ferruginosus mariaë*. Walden's Scimitar Babbler.

Previous records.—Karen Hills, type locality (Wardlaw Ramsay).

Specimens.—Nattaung 1 ♂, Thandaung 1 ♀.

Noted.—A scarce bird. The Nattaung specimen was obtained at 7,500 feet on Sosiko and the Thandaung one at 4,000 feet in a bamboo thicket beside the Leiktho mule path. We saw no others.

216. *Pomatorhinus o. ochraceiceps*. Lloyd's Scimitar Babbler.

Previous records.—Karen Hills and Karenni (Wardlaw Ramsay).

Specimens.—Nattaung 1 ♂; Thandaung 1 ♂.

Noted.—Likewise scarce and solitary. The Nattaung specimen was obtained at 3,400 feet beside a stream, and another was seen at 5,000 feet; the Thandaung specimen was obtained at 4,500 feet and one other was seen.

All were in bamboo thickets. It has a single musical call-note unlike that of most *Pomatorhinus*, and also low notes.

223. *Pomatorhinus erythrogenys imberbis*. Salvadori's Scimitar Babbler.

Previous records.—Karenni (Wardlaw Ramsay); Yado, type locality (Salvadori).

Specimens.—Nattaung 1 ♀; Thandaung 1 ♂.

Noted.—Not uncommon and seen in pairs and small parties in *ponzo* and bamboo thickets. The call-note is loud and distinctive: *callow-creeee*, *callow-creeee*, with variations. It also utters a distinctive harsh swearing call.

228. *Timalia pileata intermedia*. Burmese Red-capped Babbler.

Previous records.—Taho (Salvadori).

Specimens.—None.

Noted.—Not seen by us, and normally a bird of the plains and foothills.

233. *Gamporhynchus rufulus torquatus*. Ring-necked Shrike-Babbler.

Previous records.—Karen Hills (Wardlaw Ramsay); Taho (Salvadori).

Specimens.—Thandaung 1 ♂.

Noted.—Not seen on Nattaung. The specimen was obtained on 22 October in a bamboo thicket at 4,500 feet, out of a party making noises rather like those of *Garrulax leucolophus*. It appears to be scarce, only one other party having been observed.

234. *Chrysomma s. sinensis*. Indian Yellow-eyed Babbler.

Previous records.—Karenni (Wardlaw Ramsay, elevation?).

Specimens.—None.

Noted.—Not seen by us. It is typically a bird of the plains and foothills, but Rippon recorded it from Kalaw in 1896-7, so that it may occur in our area: so far there seem to be no certain records from above 3,000 feet.

241. *Pellorneum subochraceum*. Malay Spotted Babbler.

Previous records.—Thandaung (Cook).

Specimens.—Nattaung 1 ♂.

Noted.—Seen or heard once or twice on Nattaung up to 5,000 feet. Common and breeding at Thandaung.

248. *Pellorneum alblventre cinnamomeum*. Rippon's Babbler.

Previous records.—None before 1939.

Specimens.—None.

Noted.—The specimen obtained in 1939 constitutes our only record of this bird.

252. *Drymocapthus t. tickelli*. Tickell's Babbler.

Previous records.—Karenni 2,500 feet (Wardlaw Ramsay).

Specimens.—Thandaung 1 ♂ (breeding), 1 ♂ (juvenile).

Noted.—The specimens were obtained in bamboo thickets, the juvenile on 24 September. The bird has a loud piercing call-note, *pit-you*, *pit-you*, etc., uttered fairly rapidly. Unlike *P. subochraceum* the birds seen were not in the least shy; it appears to be rather scarce but is a resident.

257. *Napothera brevicaudata venningi*. Venning's Wren-Babbler.

Previous records.—None before 1939.

Specimens.—Nattaung 1 ♂, 1 ♀.

Noted.—Not seen at Thandaung. This is typically a bird of rocky stream beds in evergreen, in which habitat we have noted several pairs from 3,500 to 5,000 feet. It has a chattering alarm-note, possibly, the one given in the F.B.I. as a prolonged *kir-r-r*, and also a mournful single note *piou*.

261. *Napothera exul bakeri*. Baker's Wren-Babbler.

Previous records.—Recorded by Harington, but no specimens traceable.

Specimens.—None from our area but one from Mt. Byingye, Southern Shan States, on 5 November 1938.

Noted.—Not seen by us.

272. *Stachyris nigriceps davisoni*. Malay Black-throated Babbler.

Previous records.—Thandaung (Harington).

Specimens.—Nattaung 2♂, 1♀; Thandaung 2♂.

Noted.—Not uncommon, and keeps mainly to bamboo thickets and undergrowth in evergreen; seen in parties and also singly in association with *Alcippe*. The call-note is *prreeee . . . prrrreeeee*.

275. *Stachyris chrysaea assimilis*. Burmese Golden-headed Babbler.

Previous records.—Karenni (Wardlaw Ramsay); Taho (Salvadori).

Specimens.—Nattaung 3♀; Thandaung 2♂, 1♀.

Noted.—This bird swarms in bamboo thickets and thick cover, in which it normally keeps low down but occasionally ascends to a height of 20 feet when feeding. It has a variety of calls: one is very like the call of *Stachyridopsis rufifrons*, about half a dozen notes on a monotone, but can be distinguished by lower pitch, slower utterance, and a distinct pause after the first note; another is a wheezy sibilant *Franklinia*-like call of 3 notes up the scale, *tzu-tzu-tzu*; others are low churring notes of alarm. If one keeps still it is a tame and confiding bird.

279. *Stachyridopsis r. rufifrons*. Hume's Red-fronted Babbler.

Previous records.—Karenni (Wardlaw Ramsay); Taho (Salvadori).

Specimens.—Thandaung 1♀ (24 September 1938).

Noted.—Scarce. One was collected last year, and one was seen this year beside the Mawchi road at 4,000 feet. This is another bird of the foothills that occasionally ascends over 3,000 feet.

284. *Mixornis rubricapilla sulphurea*. Gyldenstolpe's Yellow-breasted Babbler.

Previous records.—Karen Hills and Karenni (Wardlaw Ramsay).

Specimens.—Thandaung 2♀ (24-9-39 and 9-10-41) 1♂ (2 November).

Noted.—Not seen on Nattaung. Not uncommon at Thandaung, where it was also seen in May and probably breeds. It swarms in the foothills.

287. *Alcippe f. fratercula*. Shan States Babbler.

Previous records.—Karen Hills and Karenni (Wardlaw Ramsay); Taho (Salvadori).

Specimens.—Nattaung 1♂, 1♀.

Noted.—Not seen at Thandaung. It appears to be a strictly high elevation form, very common on Nattaung over 5,000 feet, but not seen lower down. The call-note is quite distinct from that of *poiocephala*.

293. *Alcippe poiocephala karenni*. Karenni Quaker Babbler.

Previous records.—Karen Hills and Karenni (Wardlaw Ramsay).

Specimens.—Nattaung 1♂; Thandaung 2♂ (1939) 1♀ (24-9-38).

Noted.—Only one party was seen on Nattaung, in *ponzo* at 3,000 feet uttering the typical *poiocephala* call; the specimen was a juvenile and had a ring of yellow feathers round the eye. This species is common at Thandaung.

297. *Schoeniparus d. dubius*. Tenasserim Tit-Babbler.

Previous records.—Pine forests north of Papun (Davison).

Specimens.—Nattaung 1♂, 2♀.

Noted.—Not seen at Thandaung, and probably absent. There is little to add to the notes in our previous paper, except that it seems partial to the cover on stream banks in dense evergreen, and sometimes ascends the lower part of a tree like a Nuthatch.

302. *Pseudominla c. castaneiceps*. Chestnut-headed Tit-Babbler.

Previous records.—Karenni (Wardlaw Ramsay).

Specimens.—Nattaung 1♂.

Noted.—Not seen at Thandaung, and probably absent. For field notes see our previous paper. It has a harsh little call-note and at times utters a rattle of ascending notes. A nest was found on top of Sosiko at 7,500 feet. The nest was worked into the moss growing on a tree at 5 feet from the ground; it was domed and made of moss and bamboo leaves, lined with a few very fine grass stems and tendrils. The eggs, 3 in number, were whitish in colour, with minute spots of blackish and brown mainly forming a ring at the larger end. The bird was flushed from the nest and watched at close quarters.

310. *Heterophasia picaoides cana*. Long-tailed Sibia.

Previous records.—Karenni 6,000' (Wardlaw Ramsay); Taho and Yado (Salvadori).

Specimens.—Nattaung 1♂.

Noted.—Not seen at Thandaung and probably absent. The call recorded in our previous paper is that of *Lalage* and not of this bird, which utters low party call-notes and has a distinctive high-pitched, but not loud, sucking note *tsip-tsip-tsip-tsip-tsip*. Not uncommon in small parties, which keep to the denser parts of the forest.

316. *Leiotila melanoleuca castanoptera*. Fea's Sibia.

Previous records.—Karen Hills (type locality, Fea).

Specimens.—None this year. See our previous paper.

Noted.—Not seen at Thandaung, and probably absent. On Nattaung a nest containing young was kept under observation from 8 to 18 April. It was built on the upper side of a pine branch about 25 feet from the ground near the top of a ridge; it was not collected but appeared to be a deep cup made chiefly of moss. Both parents fed the young at regular intervals throughout the day. A Crow and a Jay were observed to approach dangerously close to the nest and were driven off by us, the Sibias being powerless against them. The calls of this species and the next are similar but distinct; Fea's Sibia starts with a very short trill which runs into three short notes on the same pitch and ends with two longer notes both dropping in pitch, whereas Walden's Sibia has a shorter call which only drops in pitch on the last note.

318. *Leiotila annectans saturata*. Walden's Sibia.

Previous records.—Karenni (type locality, Walden).

Specimens.—Nattaung 1♂.

Noted.—Not seen at Thandaung, and probably absent. It is rather less common than Fea's Sibia, but very similar in habits and choice of habitats, one was observed bathing in a stream in evergreen at about mid-day.

324. *Actinodura r. ramsayi*. Ramsay's Barwing.

Previous records.—Karenni (type locality, Wardlaw Ramsay).

Specimens.—None this year.

Noted.—There is nothing to add to our previous notes.

331. *Staphidia castaneiceps striata*. Tickell's Staphidia.

Previous records.—Mr. J. M. D. Mackenzie shot two birds off nests containing eggs on 3 and 14 April 1928 at Thandaung.

Specimens.—Nattaung 1♂; Thandaung 3♂, 1♀.

Noted.—Resident and fairly common in parties, which keep to the lower canopy and top of the undergrowth.

334. *Siva strigula castaneicauda*. Hume's Siva.

Previous records.—Nattaung (Wardlaw Ramsay).

Specimens.—Nattaung 1♂.

Noted.—Not seen at Thandaung and probably absent. This bird appears to be restricted to the Pine-Rhododendron association on the higher slopes of

Nattaung, where it is common. The black moustachial stripe, brown crown and yellowish breast are diagnostic. The call-note is *too-sweet-sweet*.

338. *Siva cyanoptera oatesi*. Oates's Blue-winged Siva.

Previous records.—Karenni (Wardlaw Ramsay).

Specimens.—Nattaung 1♂, 2♀.

Noted.—Not seen at Thandaung and probably absent. Rather scarce on Nattaung; parties were seen on two or three occasions only, working through the canopy like a party of Tits or Staphidias and uttering a *cree-cree* call-note. Seen in open forest and roadside trees between 4,500 and 5,500 feet.

349. *Ixulus humilis clarkii*. Oates's *Ixulus*.

Previous records.—None before 1939.

Specimens.—Nattaung 1♀, 1♂;

Noted.—Not seen at Thandaung and probably absent. Except that the call-note might be rendered *chit-a-wit* repeated there is nothing to add to our previous notes.

350. *Herpornis x. xantholeuca*. White-bellied *Herpornis*.

Previous records.—Karen Hills 4,000' (Wardlaw Ramsay).

Specimens.—Thandaung 1♀ (24 September).

Noted.—Scarce. One bird was noted bathing in a stream in evergreen in the middle of the day on Nattaung, and two pairs were seen in undergrowth on the Leikho mule path early in May, where they were no doubt breeding. A very quiet and unobtrusive bird; the only note heard was a bleating call of 3 notes.

353. *Cutia n. nipalensis*. Nepal *Cutia*.

Previous records.—Yado (Salvadori); Karenni (Wardlaw Ramsay).

Specimens.—Nattaung 1♀.

Noted.—Not uncommon in the pine forests. The field characteristics of this beautiful bird are the grey head, rufous upper-parts striped with black, conspicuous light rufous upper tail-coverts, white chin and throat, and flanks heavily barred white and black. The call, described in our previous paper, is repeated any number of times from 6 to 160 or more.

355. *Pteruthius erythropterus aeralatus*. Tickell's Shrike-Babbler.

Previous records.—Karenni (Wardlaw Ramsay).

Specimens.—Nattaung 1♀; Thandaung 1♀ (24-9-39), 1♀ (30-4-41).

Noted.—See our previous paper. Common at Thandaung and noted in May. The male sometimes utters a *pink* note like that of a Chaffinch.

The usual call-notes are:—

1. *Cha-chew-cha-chew*.
2. *Chu-wip-chip-chip*.
3. *Cha-cha-chip, cha-cha-chip* uttered rapidly.

356. *Pteruthius molanotis*. Chestnut-throated Shrike-Babbler.

Previous records.—None.

Specimens.—Nattaung 2♂, 1♀.

Noted.—Not seen at Thandaung, and probably absent. On Nattaung noted up to 5,500 feet. The few birds seen resembled *Phylloscopi* in the way they worked through the foliage in the tree-tops.

357. *Pteruthius aenobarbus intermedius*. Hume's Shrike-Babbler.

Previous records.—'Toungoo', probably Karen Hills (specimens in British Museum).

Specimens.—Nattaung 1♂.

Noted.—Only the one bird was seen. Evidently scarce.

362. *Aegithina t. tiphia*. Common Iora.

Previous records.—Yado (Salvadori); Karenni (Wardlaw Ramsay).

Specimens.—None.

Noted.—Though common enough in Toungoo town we have not come across it in the hills.

368. *Chloropsis a. aurifrons*. Gold-fronted Chloropsis.

Previous records.—Yado (Salvadori); Karenni (Wardlaw Ramsay).

Specimens.—None.

Noted.—At Thandaung.

371. *Chloropsis hardwickii malayana*. Orange-bellied Chloropsis.

Previous records.—Taho and Yado (Salvadori); Thandaung (Cook); Karenni 3,500 to 4,000 feet (Wardlaw Ramsay).

Specimens.—None.

Noted.—Thandaung and Nattaung.

372. *Chloropsis c. cochinchinensis*. Burmese Chloropsis.

Previous records.—Karen Hills (specimens in British Museum); Karenni 1,600 feet (Wardlaw Ramsay).

Specimens.—None.

Noted.—One bird was noted singing at Thandaung on 23 September. None of the three species of Chloropsis can be described as common; most of those observed were in trees beside the road.

376. *Mesia a. argenteauris*. Silver-eared Mesia.

Previous records.—Karen Hills and Karenni 1,500-4,000 feet (Wardlaw Ramsay).

Specimens.—None this year.

Noted.—Very common on Nattaung up to 5,000 feet in *ponzo*, but comparatively scarce at Thandaung. It has a loud cheerful call, *we are very well today boys*.

377. *Minla i. ignotincta*. Red-tailed Minla.

Previous records.—None before 1939.

Specimens.—None this year.

Noted.—Common down to 5,000 feet on Nattaung; not seen at Thandaung and probably absent. The black crown with long broad white supercilia on each side, and the red on the wings and tail are diagnostic.

381. *Criniger flaveolus burmanicus*. Burmese White-throated Bulbul.

Previous records.—Karen Hills and Karenni (Wardlaw Ramsay); Karen Hills (Salvadori).

Specimens.—Nattaung 1 ♀; Thandaung 1 ♀.

Noted.—On Nattaung it was quite common in the Kemapyu drainage below 3,500 feet but was not observed elsewhere. In Thandaung it was not uncommon in March to May and may be a hot weather immigrant to breed, none having been seen in September, October or November. It has a curious frog-like call-note.

388. *Microscelis psaroides concolor*. Burmese Black Bulbul.

Previous records.—Karen Hills and Karenni (Wardlaw Ramsay); Karen Hills (Salvadori).

Specimens.—None this year.

Noted.—Common both on Nattaung and at Thandaung.

390. *Cerasophila thompsoni*. Bingham's White-headed Bulbul.

Previous records.—Ranges from Mogok in the Northern Shan States to the Dawnas and Amherst in Northern Tenasserim, but does not appear to have been recorded previously from our area.

Specimens.—Thandaung 1 ♂ juv., 10 juv. (juvenile hitherto unknown) obtained on 8 May.

Noted.—One party was seen on Nattaung and several pairs in Thandaung in the hot weather; it may also be an immigrant to breed, and is not the common bird that it is on Mt. Byingye further north.

393. *Ixos flayala hildebrandi*. Hildebrand's Brown-eared Bulbul.

Previous records.—Karen Hills (Wardlaw Ramsay and Salvadori).

Specimens.—Nattaung 10; Thandaung 1 ♂ (25 September).

Noted.—The only party seen on Nattaung was in *ponzo* at 4,000 feet. At Thandaung we have noted a few parties along the Leiktho mule path. It has loud and pleasant call-notes, one of which is *keep, keep on going*.

395. *Ixos maccllelandi tickelli*. Tickell's Bulbul.

Previous records.—Karen Hills (Salvadori); Karenni 2,500-4,000 feet (Wardlaw Ramsay).

Specimens.—Nattaung 1 ♂.

Noted.—Common on Nattaung and a few birds are resident at Thandaung, but it is restricted to evergreen and temperate forest. It has a loud distinctive call-note, a sucking *sip-sip-sip*; also a call of three notes on an ascending scale and a mewling call.

A nest was found in temperate forest at 7,500 feet on Sosiko. It was very neatly made of moss and dead bamboo leaves, lined with rootlets and suspended by cobwebs from two horizontal twigs of bamboo at 10 feet from the ground. The eggs, 2 in number, were typical Bulbul's eggs, whitish-green in ground colour with mauve and purple spots over the whole surface.

397. *Alcurus striatus*. Striated Green Bulbul.

Previous records.—Karen Hills.

Specimens.—None this year.

Noted.—See our previous paper. Not seen at Thandaung and probably absent. It is rarely seen outside dense evergreen but is a fine songster.

401. *Molpastes cafer nigripileus*. Tenasserim Red-vented Bulbul.

Previous records.—Karen Hills (Wardlaw Ramsay).

Specimens.—Thandaung 1 ♂, 1 ♀.

Noted.—Two or three pairs are breeding residents at Thandaung. To solve the problem of the relationships between *M. c. nigripileus*, *M. chrysorrhoides klossi*, and *M. c. burmanicus*: a problem that has puzzled ornithologists since before Oates's day; a good series of all three is required from different localities and elevations in the Karen Hills and Karenni. So far as we know at present, *burmanicus* is the common plains bird round Toungoo, *nigripileus* is the form at Thandaung, and *klossi* is the form on Nattaung, but elsewhere the distributions of these last two show much interlacing, and they are so similar in appearance that sight records cannot be accepted.

402. *Molpastes chrysorrhoides klossi*. Siamese Red-vented Bulbul.

Previous records.—Karenni (Wardlaw Ramsay).

Specimens.—None this year.

Noted.—On Nattaung a pair, probably of this form, was seen at the exact spot where a specimen was obtained last year.

409. *Xanthix flavescens vividus*. Mulayit Bulbul.

Previous records.—Karen Hills and Karenni (several authorities).

Specimens.—Nattaung 1 ♀; Thandaung 1 ♂.

Noted.—Swarms all over the *ponzo* and *taungyas* on Nattaung, and is equally abundant at Thandaung; not seen over 6,000 feet.

412. *Otocompsa jocosa peguensis*. Burmese Red-whiskered Bulbul.

Previous records.—Karen Hills and Karenni (several authorities).

Specimens.—Thandaung 1 ♂.

Noted.—Fairly common on Nattaung below 4,000 feet in the *taungyas* and extremely so in the tea estate at Thandaung. The red whisker is prominent in the field, but moulting birds in May show none at all and very little red under the tail.

413. *Otocompsa f. flaviventris*. Black-crested Yellow Bulbul.

Previous records.—Karen Hills and Karenni (several authorities).

Specimens.—None this year.

Noted.—Seen occasionally both on Nattaung and at Thandaung, not above 4,500 feet.

421. *Iole virescens* subsp. Olive Bulbul.

Previous records.—Karen Hills (Wardlaw Ramsay).

Specimens.—Thandaung 1 ♀.

Noted.—Not seen on Nattaung, but probably occurs at low elevations. It is not uncommon in the evergreen on the road up to Thandaung, and in Thandaung itself, and appeared to be breeding in May. Easily recognised by its bleating call-note.

426. *Pycnonotus xanthorrhous*. Anderson's Yellow-vented Bulbul.

Previous records.—Karen Hills and Karenni.

Specimens.—None.

Noted.—Seen on Nattaung in open country up to 4,500 feet. Distinguished from *Xanthixus flavescens*, which it resembles, by absence of white spots in front of the eyes and by the brighter yellow of the under tail-coverts.

[427. *Pycnonotus f. finlaysoni*. Finlayson's Stripe-throated Bulbul.

***Pycnonotus b. blanfordi*.** Blanford's Olive Bulbul.

Wardlaw Ramsay obtained both species in the Karen Hills (elevation not stated) according to Oates, but his specimens in the British Museum are labelled Toungoo. We saw neither species and if they occur at all they are probably confined to the foothills, *P. blanfordi* is common in Toungoo town.]

[439. *Microtarsus atriceps*. Black-headed Bulbul.

Wardlaw Ramsay obtained it in Karenni (elevation not stated) and there are specimens in the British Museum labelled Karen Hills, but it remains to be proved that this species occurs above 3,000 feet; we have only seen it in the plains.]

454. *Certhia discolor shanensis*. Karenni Treecreeper.

Previous records.—Karenni 5,000-6,000' (Wardlaw Ramsay).

Specimens.—Nattaung 1 ♂, 1 ♀.

Noted.—Not seen at Thandaung and probably absent. There is nothing to add to the notes in our previous paper.

[471. *Pnoepyga a. albiventris*. Scaly-breasted Wren.

Wardlaw Ramsay recorded this from Karenni and did not record *pusilla*; in his collection in the British Museum there is a specimen of *pusilla* but none of *albiventris*; it seems likely that he confused the two. We saw no signs of *albiventris*.]

472. *Pnoepyga p. pusilla*. Brown Wren.

Previous records.—See under *albiventris*.

Specimens.—Nattaung 1 ♂, 1 ♀.

Noted.—Not seen at Thandaung. On Nattaung it is not uncommon wherever flat stretches with a growth of ferns and creepers border streams in evergreen. The note is a single *zip* uttered at varying intervals.

475. *Tesia c. cyaniventer*. Slaty-bellied Wren.

Previous records.—Karen Hills.

Specimens.—Nattaung 1 ♂, belonging to the form *olivea*.

Noted.—Quite one of the commonest birds on Nattaung, where every little moist nullah seems to hold a pair. It has two very distinctive call-notes: one consists of 3 or 4 hesitant single notes, up and down, followed by what can only be described as an outburst of noise, with a surprising volume for so small a bird; the other, chiefly heard in the mornings and evenings, consists of 3 single notes descending in pitch with a marked pause between each note: *three* (pause) *blind* (pause) *mice*. A few pairs are resident in Thandaung.

476. *Tesia c. castaneocoronata*. Chestnut-headed Wren.

Previous records.—None.

Specimens.—Nattaung 1 ♂, 1 ♀.

Noted.—Seen only in the Wrens' Paradise on Sosiko, 7,000 to 7,500 feet. The call is a single rather loud note *tweet*, which attracts attention. In habits it resembles the preceding species, and both have been seen to ascend trees to a height of 20 to 30 feet, though this is unusual.

[483. *Larvivora cyane*. Siberian Blue Chat.

Cook obtained one from the lower hills near Thandaung and Davison found it common in Tenasserim, not ascending the higher hills. Its occurrence over 3,000 feet in our area remains to be proved.]

488. *Brachypteryx cruralis*. White-browed Shortwing.

Previous records.—Karenni 5,000 feet (Wardlaw Ramsay).

Specimens.—Nattaung 1 ♂.

Noted.—Not seen at Thandaung. The Shortwings keep almost entirely to tiny streams in evergreen where the cover is very thick. They are very tame and confiding, and almost invariably greet the intruder with a burst of song, which is characterised by its compass of high and low notes, with odd sucking and popping noises thrown in.

489. *Brachypteryx leucophrys nipalensis*. Nepal Shortwing.

Previous records.—None before 1939.

Specimens.—Nattaung 1 ♀.

Noted.—Not seen at Thandaung.

492. *Saxicola c. caprata*. Burmese Stonechat.

Previous records.—Karen Hills; Karenni (Wardlaw Ramsay).

Specimens.—None.

Noted.—A breeding immigrant to Thandaung in the hot weather. It breeds in large numbers all over the tea estate in April and May. On Nattaung it was seen in *Taungyas* below 5,000 feet.

496. *Saxicola torquata* subsp. Bush Chat.

Previous records.—Pine forests of the Salween (*Ibis* 1938 p. 222).

Specimens.—None.

Noted.—Not seen by us.

502. *Rhodophila ferrea* Dark Grey Bush Chat.

Previous records.—Karen Hills and Karenni (Wardlaw Ramsay).

Specimens.—None this year.

Noted.—Common on Nattaung and breeding there; also seen at Thandaung, but not in the hot weather.

519. *Henicurus schistaceus*. Slaty-backed Forktail.

Previous records.—Karen Hills (Wardlaw Ramsay).

Specimens.—None this year.

Noted.—Common on Nattaung along shady streams and noted down to 3,000 feet. Probably occurs near Thandaung. Its call is a high-pitched single note.

521. *Henicurus leschenaulti indicus*. Leschenault's Indian Forktail.

Previous records.—Thandaung, breeding (Cook).

Specimens.—None this year.

Noted.—Common on Nattaung in pairs and often seen on the same stretch of stream as the last species. In addition to the usual Forktail note it has a harsh screech of alarm very like that of *Myiophoneus*, but not quite so loud. Also noted at Thandaung.

534. *Chaimarhornis leucocephala*. White-capped Redstart.

Previous records.—None before 1939.

Specimens.—None.

Noted.—A bird was seen on the stream running through the tea estate in Thandaung, in March but not in April-May, so that it may not breed in Thandaung itself. For Nattaung see our previous paper.

– **535. *Rhyacornis f. fuliginosa*.** Plumbeous Redstart.

Previous records.—None south of the Southern Shan States.

Specimens.—None.

Noted.—A bird in female dress was observed for several days at the end of March on the Kolo stream, Nattaung, at 4,000 feet.

542. *Calliope calliope*. Common Rubythroat.

Previous records.—Karen Hills; Karenni (Wardlaw Ramsay).

Specimens.—None.

Noted.—A male was noted in 1939 on Nattaung, and a male was seen on 24 March 1940 in the tea estate at Thandaung.

554. *Myiomela leucura*. White-tailed Blue Robin.

Previous records.—Karen Hills; Karenni (Wardlaw Ramsay).

Specimens.—Nattaung 1♂, 1♀.

Noted.—Not seen at Thandaung. The specimens were obtained in a shady stream between 3,000 and 3,500 feet, and another bird was seen in the Wrens' Paradise on Sosiko at 7,000 feet.

558. *Copsychus s. saularis*. Indian Magpie-Robin.

Previous records.—Karen Hills; Karenni (Wardlaw Ramsay).

Specimens.—None.

Noted.—Noted in *taungyas* on Nattaung up to 4,000 feet, but not seen at Thandaung, where one would expect to find it.

563. *Kittacincta malabarica indica*. Indian Shama.

Previous records.—Karen Hills and Karenni.

Specimens.—None.

Noted.—Mainly a bird of the foothills, but one was noted near Thandaung on 2 November.

[**576. *Turdus pallidus*.** Pale Thrush.

Oates records that Wardlaw Ramsay obtained one in Karenni in January and Davison another on Mt. Mulayit in Northern Tenasserim; the birds in question are *Turdus feae* (Ticehurst, *Ibis* 1939, p. 350).]

581. *Turdus o. obscurus*. Dark Thrush.

Previous records.—Karen Hills (Salvadori); Thandaung (Cook).

Specimens.—None this year.

Noted.—There is nothing to add to our previous notes.

583. *Turdus feae*. Fea's Thrush.

Previous records.—Karenni (Wardlaw Ramsay).

Specimens.—None.

Noted.—This was one of the few species previously recorded from our area that we failed to encounter.

585. *Geokichla s. sibirica*. Siberian Ground Thrush.

Previous records.—None?

Specimens.—Nattaung 2♂, 2♀.

Noted.—Common on Nattaung, either singly or in small parties, along streams in evergreen; we mistook the female specimens for *Oreocincla dixonii*. Not seen at Thandaung.

586. *Geokichla sibirica davisonii*. Davison's Ground Thrush.

Previous records.—Karen Hills and Karenni (Wardlaw Ramsay).

Specimens.—None.

Noted.—Another bird we did not encounter.

587-8. *Geokichla citrina* subsp. Orange-headed Ground Thrush.

Previous records.—Karenni (Wardlaw Ramsay).

Specimens.—Nattaung 1♀.

Noted.—Only one bird was seen, at a buffalo wallow also frequented by a party of 4 *Geokichla sibirica*; not seen at Thandaung. It is evidently scarce.

595. *Oreocincla d. dauma*. Small-billed Mountain Thrush.

Previous records.—Karen Hills (Wardlaw Ramsay).

Specimens.—Nattaung 1♀.

Noted.—Several birds were noted on Nattaung, always beside paths near the tops of dry ridges in pine forest, in contrast to the other Thrushes which were all seen in or near streams. The specimen, with ovary enlarging, was one of a pair. The race *aurea* might occur as a winter visitor.

599a. *Oreocincla dixonii*. Plain-backed Mountain Thrush.

Previous records.—Karenni 5,000 feet (Wardlaw Ramsay).

Specimens.—None.

Noted.—This Thrush also eluded us.

604. *Zoothera marginata*. Lesser Brown Thrush.

Previous records.—Karen Hills and Karenni (Wardlaw Ramsay).

Specimens.—None this year.

Noted.—The specimen obtained in 1939 represents our only encounter with this species.

605. *Monticola rufiventris*. Chestnut-bellied Rock Thrush.

Previous records.—Karenni (Wardlaw Ramsay); Thandaung (Cook).

Specimens.—None.

Noted.—Two pairs were seen on Nattaung in pine forest, at 5,500 feet and 7,000 feet.

608. *Monticola solitaria pandoo*. Indian Blue Rock Thrush.

Previous records.—Karen Hills.

Specimens.—Nattaung 1♂.

Noted.—Two pairs had arrived in Thandaung when we first went up on 23 September; they were still there in March but had left by 24 April. As the Nattaung specimen was obtained on 9 April the return migration must take place about the middle of April.

It is a typical bird of the enormous granite boulders of the tea estate, and of the stone culverts along the Thandaung road; one bird is nearly always to be seen on the roof of the Circuit House.

614. *My ophoneus coeruleus temminckii*. Himalayan Whistling Thrush.

615. *My ophoneus coeruleus eugenei*. Burmese Whistling Thrush.

Previous records.—Karen Hills (Wardlaw Ramsay, both races).

Specimens.—None this year.

Noted.—There is often a bird beside the road up to Thandaung. Common along rocky streams in Karenni.

617. *Cochoa purpurea*. Purple Thrush.

Previous records.—Thandaung (Cook).

Specimens.—None.

Noted.—We saw none.

618. *Cochoa viridis*. Green Thrush.

Previous records.—Hopwood's record of a bird breeding at Thandaung in 1905 is the only previous record for the whole of Burma.

Specimens.—Nattaung 1♂, 1♀.

Noted.—The specimens were obtained out of a party of 4 birds flying about in the tops of tall trees in evergreen at 5,000 feet; the understorey was not dense, and the birds were flying freely from tree to tree, occasionally coming down to a tree in the understorey. No notes were heard.

632. *Hemichelidon sibirica fuliginosa*. Sooty Flycatcher.

Previous records.—Karen Hills (Wardlaw Ramsay).

Specimens.—Thandaung 1♀ (24 September).

Noted.—Although this species had not left Thandaung by 12 May it showed no signs of breeding and was absent later in the rains; it appears to be a winter visitor that arrives early and leaves late.

635. *Hemichelidon ferruginea*. Ferruginous Flycatcher.

Previous records.—None before 1939.

Specimens.—Thandaung 1♂ (24 September).

Noted.—The specimen was obtained in oak forest beside the Leiktho mule path. On Nattaung it is very common along small streams running through evergreen. No evidence of breeding was obtained.

636. *Muscicapa s. strophiatea*. Orange-gorgeted Flycatcher.

Previous records.—Mt. Byingye and Mt. Mulayit.

Specimens.—None.

Noted.—Not seen by us; though there is no record actually from our area it is certain to occur.

639. *Muscicapa parva albicilla*. Eastern Red-breasted Flycatcher.

Previous records.—Karen Hills (Wardlaw Ramsay).

Specimens.—Nattaung 1♀.

Noted.—This species had already arrived at Thandaung on 23 September, and the Nattaung specimen was obtained on 10 April, after which no more were seen. It no doubt winters in the hills.

642. *Muscicapula hodgsoni*. Rusty-breasted Blue Flycatcher.

Previous records.—Karen Hills 4,000 feet (Wardlaw Ramsay).

Specimens.—Nattaung 1♂.

Noted.—Common on Nattaung and a male was seen in Thandaung in March. It is a shy bird and keeps much to thick undergrowth and bamboo thickets.

643. *Muscicapula h. hyperythra*. Rufous-breasted Blue Flycatcher.

Previous records.—None before 1939.

Specimens.—None this year.

Noted.—The short white eyebrow of the male is diagnostic. It has a characteristic little song, almost a wheeze, consisting of four notes; the first,

second and fourth are of the same pitch, the third being much lower; there is then a slight pause followed by two notes resembling *see-saw*, the first note being much higher than the second. In its choice of habitat it resembles the Shortwings, preferring dense undergrowth along small streams in evergreen forest, and like them it is tame and confiding.

646. *Muscicapula tricolor cerviniventris*. Eastern Slaty-blue Flycatcher.

Previous records.—Karen Hills (Salvadori).

Specimens.—Nattaung 1 ♀.

Noted.—Not seen at Thandaung. A scarce bird, and from what we saw of it rather a skulker. A male, either of this or the next species, was seen at 4,500 feet beside the Mawchi road and the specimen was obtained a fortnight later close to the same spot, making a noise like the note of *Muscicapa parva* whilst skulking in a bush.

648. *Muscicapula superciliaris æstigma*. Little Blue-and-White Flycatcher.

Previous records.—Karenni 2,500 (Wardlaw Ramsay).

Specimens.—None.

Noted.—This bird eluded us.

649. *Muscicapula m. melanoleuca*. Indian Little Pied Flycatcher.

Previous records.—Karen Hills. Karenni (Wardlaw Ramsay).

Specimens.—Thandaung 1 ♂ (30-4-41).

Noted.—See our previous notes. Its call-note may be heard in the heat of the day on dry ridge tops when other birds are quiet. It is less common at Thandaung, but probably breeds there.

651. *Muscicapula sapphira*. Sapphire-headed Flycatcher.

Previous records.—None before 1939.

Specimens.—Nattaung 1 ♂.

Noted.—The specimen was obtained in the understorey in pine forest at 5,000 feet, and no others were seen. It is evidently scarce and was not seen at Thandaung.

652. *Muscicapula vivida oatesi*. Rufous-bellied Blue Flycatcher.

Previous records.—None from our area, but has been obtained on Mt. Byingye and Mt. Mulayit.

Specimens.—Nattaung 1 ♀.

Noted.—The specimen was one of a pair, both in female plumage, behaving much like the Large Niltava in the understorey in evergreen at 4,500 feet. No others were seen and it seems to be rare. Not seen at Thandaung.

655. *Muscicapula u. unicolor*. Pale Blue Flycatcher.

Previous records.—Karen Hills (Salvadori).

Specimens.—None.

Noted.—Not seen by us.

659. *Muscicapula rubeculoides dialilaema*. Salvadori's Blue-throated Flycatcher.

Previous records.—Taho (type locality, Salvadori); Karenni (Wardlaw Ramsay).

Specimens.—Nattaung 1 ♂; Thandaung 2 ♂.

Noted.—Common. A pair was kept under observation in Thandaung from 24 April to 12 May. The male sang daily in a small defined territory and the female only appeared two or three times, and was probably sitting. Numerous other singing males were noted elsewhere in the same period; they were also heard singing in October. The usual phrase is *tchik-tchik* and then a run of 6 notes on the same pitch except for the second, which is higher; the first *tchik-tchik* is harsh and the other notes are whistled. There is also a musical warble by way of variation. The race *rubeculoides* may occur as a winter visitor.

658a. *Muscicapula banyumas whitei*. Bhamo Blue Flycatcher.

Previous records.—Karenni (Wardlaw Ramsay).

Specimens.—None.

Noted.—Birds seen at Thandaung with rufous running up to the chin, thought at the time to be *diallaema*, were probably this.

665. *Eumyias t. thalassina*. Verditer Flycatcher.

Previous records.—Karen Hills; Karenni 700-5,000' (Wardlaw Ramsay).

Specimens.—None.

Noted.—Not uncommon on Nattaung and also seen at Thandaung, where Cook recorded it as common and breeding.

671. *Anthipes moniliger leucops*. Sharpe's White-gorgeted Flycatcher.

Previous records.—Karenni (Wardlaw Ramsay).

Specimens.—Nattaung 1♂.

Noted.—It keeps to bamboo thickets or undergrowth in evergreen and is quiet, unobtrusive, and rather scarce. Seen once at Thandaung.

674. *Alseonax l. latirostris*. Sumatran Brown Flycatcher.

Previous records.—None.

Specimens.—Thandaung 1♂.

Noted.—The specimen was obtained on 25 September from a tree beside the Leiktho mule path at 4,500 feet, and was probably a passage migrant; we saw no others.

679. *Culicicapa ceylonensis calochrysa*. Burmese Grey-headed Flycatcher.

Previous records.—Karen Hills; Karenni 3,500' (Wardlaw Ramsay).

Specimens.—None.

Noted.—Very common both on Nattaung and at Thandaung; it is partial to shady streams and several pairs were noted as probably breeding.

682. *Niltava g. grandis*. Large Niltava.

Previous records.—None before 1939.

Specimens.—Nattaung 3♂, 1♀.

Noted.—It is confined to the densest and shadiest parts of the evergreen, and is the most markedly characteristic bird of this type of habitat. It does not occur at Thandaung, but has been obtained on Mt. Byingye.

684. *Niltava s. sundara*. Indian Rufous-bellied Niltava.

Previous records.—Taho (Salvadori). Karenni 4,000 feet (Wardlaw Ramsay).

Specimens.—Nattaung 1♂, 1♀.

Noted.—The only birds seen were along a small stream in evergreen at 4,000 feet; both were in the same valley, but about $\frac{1}{2}$ mile apart. The white throat patch of the female is diagnostic. The male was making sallies from a perch, but not always returning to the same perch. Not seen at Thandaung.

685. *Niltava macgrigoriae*. Small Niltava.

Previous records.—Karen Hills and Karenni (Wardlaw Ramsay).

Specimens.—Nattaung 1♂.

Noted.—Two males and a female were seen along a shady stream at 3,500 feet. The female was observed constructing a nest on the internode of a bamboo, which had been cut at 5 feet from the ground leaving a stump standing. When last seen on 16 April the nest was incomplete, and consisted of a mossy cup.

688. *Tchitrea paradisi (indochinensis?)* Paradise Flycatcher.

Previous records.—Karen Hills (Wardlaw Ramsay).

Specimens.—Nattaung 1♂.

Noted.—The specimen was obtained in bushes beside a stream at 3,500 feet; it was in the chestnut plumage, as was also a bird seen at Thandaung on 7 October 1941.

693. *Hypothymis azurea styani*. Northern Indian Black-naped Flycatcher.

Previous records.—No definite record?

Specimens.—None.

Noted.—Chiefly a bird of the foothills and we have seen it only once on Nattaung and once at Thandaung, both times below 4,000 feet.

699. *Chelidorynx hypoxanthum*. Yellow-bellied Flycatcher.

Previous records.—Karen Hills (Wardlaw Ramsay).

Specimens.—None this year.

Noted.—Confined to shady evergreen streams over 6,000 feet, and to temperate forest. A number of birds were seen in the Wrens' Paradise on Sosiko. The bright yellow forehead, black band through eye, and habit of frequently fanning the tail, which has some white in it, are diagnostic. It is tame and confiding.

[701. *Rhipidura aureola burmanica*. Burmese White-browed Fantail Flycatcher.

Cook noted this as common at Thandaung but it seems likely that he confused it with the next species; there are no other records or specimens from our area. Oates found it near Toungoo, but it is typically a bird of dry scrub country in the plains and foothills.]

703. *Rhipidura a. albicollis*. White-throated Fantail Flycatcher.

Previous records.—Karen Hills (Salvadori); Thandaung (Cook); Karenni (Wardlaw Ramsay).

Specimens.—None this year.

Noted.—Common on Nattaung and also at Thandaung, at all elevations wherever shady streams and wet thickets occur; it appears to breed early, and a juvenile was again seen in mid-April.

(To be continued)



Sayeedud-Din.—*Ionidium suffruticosum* Ging.

(For explanation see end of article).

SOME COMMON INDIAN HERBS WITH NOTES ON THEIR ANATOMICAL CHARACTERS.

BY

M. SAYEEDUD-DIN.

Prof. of Botany, Osmania University, Hyderabad Deccan.

(With three plates).

(Continued from page 172 of Vol. xliii, No. 2).

X—IONIDIUM SUFFRUTICOSUM Ging.

(VIOLACEAE).

SYNONYMY AND SYSTEMATIC DESCRIPTION.

Ionidium suffruticosum Ging. in DC. Prodr. i, 311; H.F.B.I., V. I, 185; Gamble. F. Pres. Madras, Pt. I, 49; Wt. Ill. t. 19; Wt. Ic. t. 308; Watt Dict. Econ. Prod. I, V. IV, 475. Syn:—*I. enneaspermum* Vent. Jard. Malm. (1803) fol. 27, Kirt. Ind. Med. Plts., V. I, 212; Dalz. & Gibs. Bomb. Fl., 12. *I. heterophyllum* Vent., Cooke Fl. Pres. Bomb., Pt. i, 52; Duthie Fl. Upper Gang. Plain, V. I, 56.

A small suffrutescent perennial herb, with many diffuse or ascending branches, glabrous or more or less pubescent. Leaves lanceolate, subsessile, with serrated margins; stipules gland-tipped, subulate. Flowers red or pink, axillary, solitary; bracts small, above the middle of the pedicel. Sepals 5, lanceolate, very acute, keeled. Petals 5, unequal, the 2 upper ones oblong, slightly longer than the sepals, the 2 lateral longer, falcate, the lowest much larger than the rest, having an orbicular or obovate limb with a long claw which is curved behind into a short spur. Stamens 5. Anthers connate or free, 2 or 4 of them gibbous or spurred at the back. Style clavate, incurved; stigma oblique. Ovary sessile, 1-celled; ovules many on 3 parietal placentas. Fruit a subglobose capsule. Seeds ovoid, acute, longitudinally striate, yellowish white. (Plates I and II). Flowers Oct.-Dec. Root, leaves and tender stalks, and fruit are medicinal (Kirtikar, 6).

INDIAN NAMES.

Ratanpurus (*Hindi*); Nilakobari, Purusharatnam, Suriyakanti (*Telugu*); Ratanpuras (*Marathi*); Orelatamara (*Malayalam*); Orilaitamarai (*Tamil*); Amburuha, Lakshmishreshta, Padma, Pushkarini, Sarada (*Sanskrit*).

Habitat.

A common weed in grassy places, fields, and open forest lands in many parts of India. Abundant from Bundelkhand and Agra, to Bengal and Ceylon (Hooker, 5); common in the Southern Concan (Dalz. & Gibs., 2); not uncommon in the districts of Agra and Delhi, and in Bundelkhand (Duthie, 3); very common in fields and waste places (Mayuranathan, 7). Distribution. Tropical Asia, Africa and Australia.

ANATOMICAL NOTES.

Structure of the leaf. (Plate III, Figs. 1 and 2). The cuticle is finely but distinctly striated. Epidermal cells are of considerable size, serving as water-reservoirs. Sabnis (8) found a similar type of epidermis in *Viola Stocksii* Boiss. The stomata belong to the Cruciferous type, being surrounded by three subsidiary cells—two big and one small. No transition to the Rubiaceous type could be seen, as is recorded by Solereder (10). They are sunk below the level of the epidermis, and are present on both surfaces, but mostly on the under surface. Internal secretory organs do not occur.

Oxalate of lime occurs in the form of clinorhombic crystals along the veins only in the leaf, and in the form of clustered crystals in the stem. Borodin (Solereder, 10) distinguishes eight types of crystals in the Violaceae. The solitary oblique crystals occurring exclusively along the veins in *Ionidium* spp. belong to the *Ionidium*-type. The hairy covering consists of simple uniseriate straight hairs in the stem, and of similar and curved hairs in the leaf (Plate III, Figs. 2 and 3). Glandular hairs do not occur.

Structure of the axis. The cuticle is striated. The epidermal cells are of considerable size as in the leaf, their outer walls being muriculate. The primary cortex consists of collenchyma and chlorenchyma. Scattered stone-cells are present in the region of the pericycle. The vessels possess simple and scalariform perforations. The pith consists of thin-walled cells.

CONCLUSIONS.

The anatomical study of *Ionidium suffruticosum* Ging. reveals the following characteristic features:—

1. Stomata are of the *Cruciferous* type.
2. Oxalate of lime occurs in the form of clinorhombic crystals along the veins only in the leaf, and in the form of clustered crystals in the stem.
3. The hairy covering consists of simple uniseriate, straight and bent hairs. No glandular hairs occur.
4. The absence of internal secretory organs either in the axis or leaf is also important.

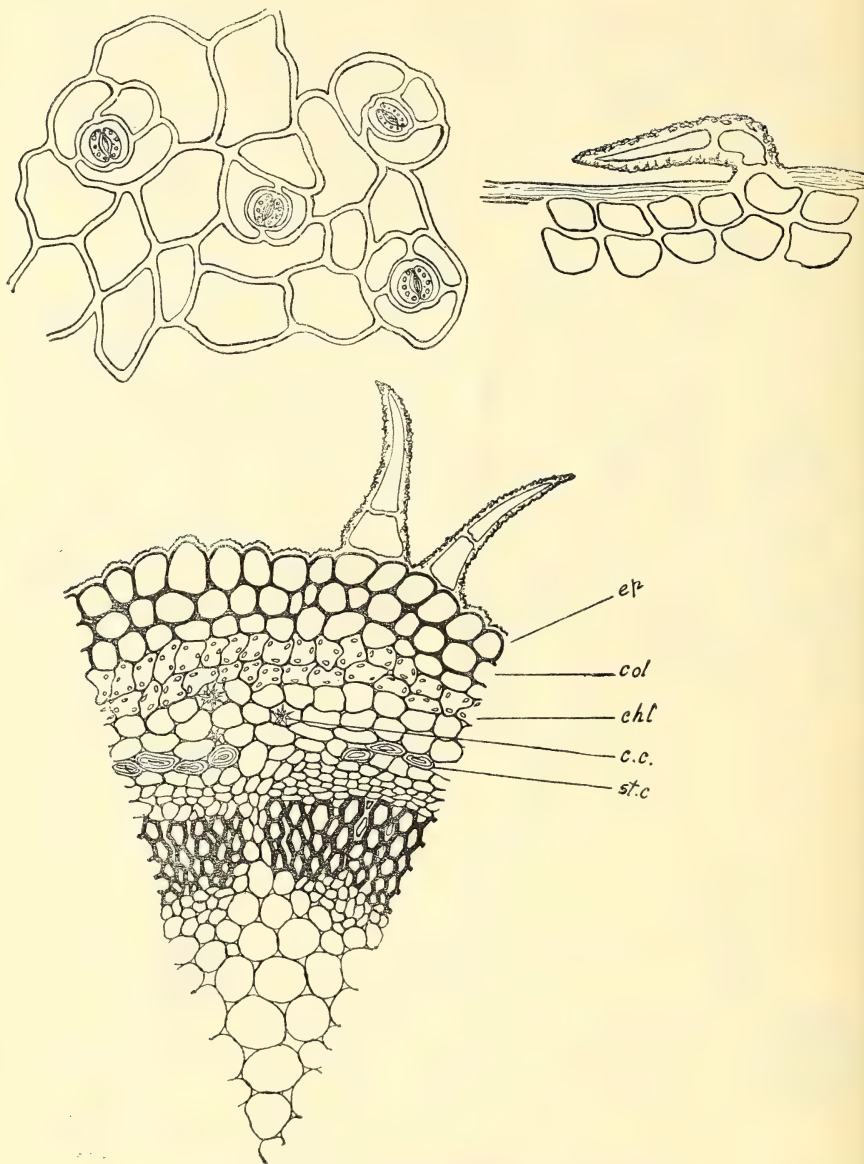
ACKNOWLEDGEMENTS.

As before my thanks are due to Mr. Sriramloo for the photograph and the drawings which were prepared under my supervision, and to some of my students for the preparation of the slides.



Sayeedud-Din. — *Ionidium suffruticosum* Ging.

(For explanation see end of article).



Sayeedud-Din.—*Ionidium suffruticosum* Ging.

(For explanation see end of article).

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EXPLANATION OF PLATES.

Ionidium suffruticosum Ging.

PLATE I.

Photograph of *Ionidium suffruticosum* Ging.

PLATE II.

- Fig. 1. Black and White drawing of *Ionidium suffruticosum* Ging. (Nat. size).
 Fig. 2. Single flower ($\times 10$).
 Fig. 3. Flower opened out, showing androecium and gynaecium. ($\times 10$).
 Fig. 4. T. S. Ovary, showing ovules arranged on three parietal placentas. ($\times 10$).
 Fig. 5. Pollen grain. ($\times 600$).

PLATE III.

- Fig. 1. Leaf-epidermis, showing the *Cruciferous* type of stomata. ($\times 300$).
 Fig. 2. Leaf-epidermis, showing a bent trichome.
 Fig. 3. T. S. Stem, showing, ep. large epidermal cells; col. collenchyma; chl. Chlorenchyma; c.c. clustered crystals of oxalate of lime; st. c. stone-cells. ($\times 300$).

SOME ADDITIONAL NOTES ON THE DISTRIBUTION OF THE AVIFAUNA OF NORTHERN BALUCHISTAN.

BY

MAJOR GENERAL A. F. P. CHRISTISON, M.C., P.S.C., B.A., M.B.O.U.,

ASSISTED BY

THE LATE DR. C. B. TICEHURST, M.A., M.R.C.S., M.B.O.U., F.R.G.S.

Since the series of articles written by Dr. Ticehurst in the *Journal* in 1926-7, little has appeared in print concerning the avifauna of Northern Baluchistan.

For four years I have made a close study of the Political Districts of Zhob, Loralai, Quetta-Pishin, Chagai, Kalat, and the Northern mountainous part of Sibi. I have been in regular correspondence with the Society and with Dr. Ticehurst, and have collected a series of specimens in all doubtful cases, and checked many of them at the British Museum and Royal Scottish Museum, while others have been checked by the Bombay Natural History Society and by Dr. Ticehurst.

There is still a great deal of research to be done in Northern Baluchistan, and this article is written in the hope that it may provide a basis for future study for ornithologists who may be stationed there.

I shall only deal with new records, and with species about which there has been controversy regarding race.

1. *Corvus corax ruficollis*.

This raven is definitely scarce. Purely a winter visitor, I have seen it half a dozen times only, on Quetta golf course, in company with *laurencei*, rooks and choughs, in hard weather from 15 December to 12 March. It is resident in Mekran, but from where these winter visitors come to us is not clear. There are not many places where *laurencei* and *ruficollis* overlap.

2. *Corvus corone orientalis*.

I obtained this crow on Shinghar, where it is resident in small numbers in the chilghoza pine forests as well as on the Takht-i-Suleiman. It lives at about 8,500 ft. and nests in April about 30 ft. up in a fork of a pine. Five eggs averaged 42×29 mm. It is not found anywhere else.

3. *Pyrhcorax graculus*.

The Alpine or Yellow-billed Chough is purely a bird of the great cliffs in the high mountains, and except when breeding is seen in small flocks of ten to fifteen. They do not descend to the valleys in winter like *Pyrhcorax pyrrhcorax*. I have seen them on Murdar, Chiltan, Zarghun, Takatu, and Khalifat, mostly at about 10,800-11,200 ft. Nests are usually in holes in inaccessible cliffs, but one I reached on Khalifat in May 1938 had four very pale yellowish grey eggs with a few bright brown spots. They averaged 40×28 mm.

4. *Nucifraga multipunctata*.

General Norton tells me he found this Slender-billed Nutcracker on the Takht-i-Suleiman in winter, and natives say it visits Shinghar also in winter. I have not been able to get there in winter to confirm this, but I saw a Nutcracker of undetermined species on Shinghar on 14th July 1940. Which nutcracker is found in our area still wants working out.

5. *Sitta kashmiriensis*.

Brook's Nuthatch is common in the chilghoza pine forests of the Takht and on Shinghar. I have found it overlapping *Sitta neumayeri tephronota*, and in 1940 found nests of both species within 80 yards of each other, the one in a chilghoza pine, and the other in the cleft of a rock inside the usual clay cone.

6. *Turdus unicolor*.

Tickell's Thrush is a regular winter visitor to Fort Sandeman, Loralai, and Quetta gardens. I had several in my garden in the winter of 1940-41. They became very tame in hard weather.

7. *Phoenicurus phoenicurus*.

Dr. Ticehurst identified a specimen I sent him from Robat on 18th April 1939 as the European Redstart.

8. *Chaimarrornis leucocephala*.

I obtained the White-capped Redstart near Hanna Lake, Quetta, on 6th March and 19th November, 1939. The earliest record is 2nd March, and Meinertzhagen reported it from Baleli on that date and on 14th April and 14th November. When it occurs it probably winters, and this must be about the S.-W. limit of its range.

9. *Oenanthe*.

The distribution of the eleven species of Wheatear which have been reported from Northern Baluchistan has taken a lot of working out, and much more research is still needed. According to old records and the indications given by specimens collected by me, the distribution seems to work out as follows:—

O. picata is a very common summer visitor, and passage migrant. It winters in the areas below about 4,000 ft., but I have seen odd ones quite happy among the big rocks at 9,000 ft. in deep snow in mid-January. Much more a bird of the rocks, it is found far higher than any of the others.

O. isabellina is common on passage, and is resident in small numbers locally, while others are summer visitors. It breeds in old rat holes, and nests are easy to find.

O. finschi barnesi is a passage migrant in small numbers. Odd pairs remain to nest or come here from further South. I got a nest on 29th April in the hills N.-E. of Nushki, and found one nest, and a family party North of Quetta. The bird was shot in each case to make sure. The nest is a flat saucer of camelthorn, lined with grassy fibres and goats' hair. The five eggs were a deeper blue than the usual chat type. There was a zone of rusty spots at the thick end, and a few odd spots elsewhere. Average 20.5×15.5 mm.

O. deserti atrogularis is common, but only as a winter visitor and on passage. It has, however, been reported as nesting round Quetta. This may be so, but I think only an odd pair nests. The Messrs. Williams found a nest on 15th May near Quetta.

I have seen a family party on 12th July and obtained an adult male.

O. xanthopyrrha chrysopygia. The Red-tailed Wheatear is quite common on passage, (earliest Quetta 24th January); the Kacha range in W. Chagai is full of them in March and April. It winters in S. Mekran, and many nest in the Hindu Kush. A few nest in the Amran Khwajah and along the Barshor hills. It is not a desert-loving bird, but frequents the small rocky perennial streams. It is one of the most interesting birds to watch. The nuptial display is very marked, and once I saw a cock bird going through the whole performance in mid-September for fifty minutes, although I could find no trace of any hen. It arrives in April and is very tame and confiding. The nest itself is unusual.

It is placed in small hollows quite low down in a rock face above water. The hollow is lined with tiny flat stones from the stream, and the cup in the middle is a deep one, and is made of grasses with a fine lining of root and grass fibres. Four to five eggs are laid, usually above 7,000ft. They are pale blue with only a few rusty spots. In one nest the eggs had no spots. Average of fourteen eggs 20.7×16 mm.

O. opistholeuca. Strickland's Chat is a scarce passage migrant. I have only obtained it between the end of February and mid-April, and once in September. Meinertzhagen obtained it near Quetta on 24th February and 21st October. There was a specimen in Old Quetta Museum from Baleli 18th March, and Dr. Ticehurst obtained one there on 11th August.

O. capistrata. Gould's Chat is also a scarce passage migrant, but a few are seen every year between mid-February and April, and in late August and September. Latest record in October.

O. deserti oreophila. The Tibetan Desert Wheatear winters in Mekran and Iranian Baluchistan in some numbers, but what route it takes I have not been able to discover. I have never seen it in the Chagai desert, though I obtained one near Nushki, and another at Robat, both in April. Dr. Ticehurst obtained it near Quetta on 28th February and 3rd March.

O. leucomela, rostrata, alboniger.

The Siberian; the pale race of Common Wheatear; and Hume's Chat; are I think, only stragglers on passage. Of *leucomela*, there are old, doubtful records by St. John from Pishin in March, and by Blanford from Quetta. Dr. Ticehurst got it at Ziarat on 5th October, and I obtained one near Nushki in March.

O. rostrata is reported to pass through Quetta between 17th March and 18th October, and I obtained one near Nushki on 14th November.

The only record for *alboniger* is one by Murray from Chaman in April; probably a mistake.

10. *Suya crinigera striatula*.]

The Brown Hill Warbler is only found in Loralai and N.-E. Zhob. It extends just into the more open parts of the pine forests on Shinghar up to 7,400 ft. It nests in May and June according to altitude about 4 ft. up in sage or wild almond bushes, or sometimes in a buddleia.

11. *Acrocephalus agricola agricola*.

Jerdon's Reed Warbler has always been considered only a passage migrant. Many winter in the Sibi-Jacobabad plain and pass through in March and April, returning from August to early October. However all do not pass through, as I found a regular breeding colony in the Malezai Lora each year. I have found 25 nests.

The nest is a deep cup woven round three or four reed stalks 18 in. to 3 ft. above water. It is made of fine reed stems lined with reed fibres, wool, goats' hair, feathers, and the seed-down of reeds. Of the 25 nests 18 had 5 eggs and 7 had 4. Colours varied from whitish to stone, and a few were greenish stone. They were blotched, streaked and spotted with dark olive, brown, dark grey, and even black, the markings being thicker at the blunt end where they tended to form a zone and sometimes a cap.

Largest 17.2×13.1 mm.; smallest 16.4×12.8 mm.; average 16.8×12.9 mm. Lt.-Colonel Darcy, R.A., was with me on one visit, and kindly checked the measurements for me. I know of no other breeding place in Baluchistan, though I have searched every likely spot.

12. *Acrocephalus scirpaceus*.

I thought I found the Reed Warbler nesting in the Malezai Lora in 1939, and 1940. I shot a bird from the nest and sent it and the eggs to Dr. Ticehurst. Owing to the war the eggs did not arrive, and the bird was so battered that Dr. Ticehurst could only say that he thought it was *scirpaceus*. I also sent a clutch of eggs to Stuart Baker, which did not arrive. The Malezai reed beds would well repay close study.

13. *Phylloscopus collybita*.

I have obtained both *tristis* and *sindianus* on passage. The common one however, is *tristis*, the Siberian Chiffchaff. It has a faint tinge of green in the upper plumage, which is dark brown. Underparts are pale buff, and both wings and tail are edged with olive-yellow. It breeds in N. Asia, and passes through to the Sibi plain and Sind from 21st February to 15th April, and later birds give song. Going South it passes through from 25th September to mid-November, but many spend the winter in pairs or singly in cantonment gardens.

P. sindianus breeds in Central Asia and Ladakh, and winters in Sind, N.-W, F.P., Punjab, U. P., and Rajputana. The wing formula is the same, but this race has no green tinge on the upper parts. It passes through farther East, and I have only obtained it twice, both in N.-E. Baluchistan in November.

A specimen obtained at Quetta by Meinertzhagen on 28th July could not be separated by Dr. Ticehurst from the typical race. It was much greener above, and had some yellow on the breast. It had at that early date completed its moult, and Dr. Ticehurst thinks it was probably a vagrant that had failed to breed.

14. *Luscinia megarhyncha golzii*.

I obtained the Eastern Nightingale at Kacha and Robat on the Iran frontier in April 1939. Natives say it does not sing or nest there.

15. *Troglodytes troglodytes neglectus*.

The Wren is very local and has not been previously recorded. I heard it in 1938 and 1939 in a secluded tangi near Ziarat, and in 1940 found it there and in two other tangis. In all I found four families of half-fledged young in June, and found one nest. It was placed in a crevice underneath a rock, and consisted of juniper bark strips tightly bound round fibres of bark and grassy roots. The lining was of finer root fibres, and some fine bark fibres with a few feathers. Eggs must have been laid in the last fortnight of May, and cocks sang up till 15th July. I obtained one but could not separate it from *neglectus*.

16. *Acridotheres tristis tristis*.

The Common Mynah I have only seen round the Staff College in Quetta where half a dozen pairs are resident at 5,800 ft. and nest regularly.

17. *Carpodacus erythrinus*.

I have cleared up the question of the distribution of the Rosefinches. Most are only passage migrants, but the intermediate race, *kubanensis*, is a summer visitor to the chilghoza forests, the juniper forests, and to those higher hills over 7,500 ft. where there are a few junipers, thorny scrub and wild briars. There it nests in wild briars, the nest being a grassy cup lined with fine juniper bark fibres or fine grass roots, and usually containing three and sometimes four eggs, of a clear blue blotched very sparsely with browns and blacks. Average size 19.8×15 mm.

Its clear calls of 'twee-twee-tweeou' and 'twee-tweeou', with accent on the second syllable, is one of the characteristic sounds of the forests. Of a large series of males obtained in summer, all were unmistakably of this race. They had throat and chest splashed with dark crimson, and a pale suffusion of pink on the abdomen.

Of the passage migrants I have identified the pale typical race and the dark race *roseatus*. The former is fairly common on passage from Sind and Mekran, where it winters, and I have obtained specimens from Chagai in October and March, the Kaisar Jungle near Nushki in September and March, and on Takatu, near Quetta, and Pishin, also in March. Males of this race are much paler all over, and only the chin, throat, and breast are rosy. *roseatus* I have not seen except in N.-E. Baluchistan, and have obtained only two specimens, in March and September. Males of this race have the throat, chest and abdomen splashed with dark crimson.

18. *Carduelis caniceps*.

Some doubt existed as to the races of the Goldfinch found in Baluchistan.

It is mainly a winter visitor, and all birds I have obtained have been the typical race, wing 83 mm. It is very common in cantonments, and sings away all winter.

Dr. Ticehurst identified three obtained in winter as the Far Eastern race *paropamisi*, and Meinertzhagen got the Eastern race *major* in Quetta on 27th February, 1913. Possibly the large flocks seen contain birds of all three races.

subulata, a larger central Asian race, wing 88 mm., is a summer visitor very locally to some of the higher hills, and no doubt breeds there. I have only found one pair nesting. This was on Takatu near Quetta at 7,500 ft., but I have seen family parties of *subulata* feeding on sunflowers in cantonments in Quetta in late July. The nest I found on Takatu was made of wool and goats' hair, lined with finer hairs and grassy fibres. Very inconspicuous, it was 15 ft. up in a fork of an old country apricot in a deserted patch of cultivation opposite the Marichak Tangi. Four young hatched out on 2nd May 1938, and I saw a family party of six on 12th July, watering within half a mile of the nest. I found another family party in Zhob, June 1942.

19. *Amandaya amandava amandava*.

From September to early December, small flocks of Red Munias appear regularly in Quetta gardens. A purely plains species, its occurrence is strange. I have seen it at this time in Chaman, Pishin, and the Barshor Valley, and in April at Baleli and Killa Abdulla. Possibly it moves down from Afghanistan in winter to the Sibi plain and Sind.

20. *Cinnyris asiatica brevirostris*.

There was a Purple Sunbird in the Church compound in Quetta from April till June, 1939.

21. *Motacilla citreola*.

There is some doubt as to the race of Yellow-headed Wagtail which is very common, and passes through in March and April. Dr. Ticehurst considers that they belong to the smaller race *verali*, described by Butlerlin (Orn. monatsb. 1909, p. 197); the type locality being Simbirsk, White Sea, East of the Urals. Most W. Indian birds belong to this race.

Seven specimens obtained by me in March varied very considerably.

No. 1, male, Malezai, Wing 82 mm.

No. 2, male Malezai, Wing 84 mm.

No. 3, male, Barshor, Wing 80 mm.

No. 4, male, Kacha, (Iran frontier), Wing 82 mm.

Nos. 5 & 6, female, Malezai, Wing 82 mm.

No. 7, female, Kacha, Iran Frontier, Wing 87 mm.

So possibly the typical race is the one of Western Chagai.

22. *Dryobates auriceps*.*Dryobates sindianus*.

D. auriceps must reach the S.-W. limit of its distribution on the Takht and Shingar, where it is common and resident. It nests in May and June in the underside of the branch of a chilghoza pine, from 15-25 ft. up. I have found it from 7,400 to nearly 10,000 ft. A nest had four eggs on 5th June, and they measured 21×16 mm.

I saw a pied woodpecker near Chautair, 16 miles East of Ziarat, on 2nd July 1940. It flew across the valley and settled in a juniper but I was unable to get a close view and cannot say if it was *auriceps* or the next named.

D. sindianus is now very local and is a bird of tamarisk and old *Pistachia cabulica* rather than of junipers and pines. It is found in Kalat, and in January 1941 there were still a few pairs in the scanty remains of the old *Pistachia cabulica* forest at Shelabagh, the Khojak and Chaman, between 4,400 and 6,600 ft.

This species nests much nearer the ground than *auriceps*, holes being rarely higher than 6-7 ft. from the ground.

23. *Picus squamatus flavirostris*.

The distribution and variations of this Green Woodpecker are interesting. I have found it resident from the Takht and Shinghar, through the Juniper forests, in the valleys where there is tamarisk and a few willows, down to the Kaisar tamarisk jungle near Nushki, and south into Kalat.

Birds from the N.-E. have the lower parts fairly heavily scaled, while specimens from Nushki are not only much paler generally, but have no scaling on the underparts. Birds from North of Quetta are intermediate. I have found nests from 4,000-9,000 ft. in *Pistachia cabulica*, willow, apricot, chilghoza, juniper, mountain ash, mulberry, and even in tamarisk scrub. In the Kaisar Jungle where there are no trees, only tamarisk scrub, the nest was in the root of a tamarisk 5 ft. below ground level, where the root was exposed in the side of a muddy nala bank, and 7 ft. above the water.

In July 1938 on Chiltan, I watched a bird watering from a hole in an old tree where water had been caught. The nearest water was four miles away.

24. *Halcyon smyrnensis smyrnensis*.

A White-breasted Kingfisher visited the Residency at Ziarat, 8,200 ft., on the 23rd and 24th June, 1938, and Sir Arthur Parsons kindly invited me to come and see it.

25. *Alcedo atthis pallasi*.

The Central Asian Kingfisher is common on passage on all the perennial streams. I was surprised to find that an odd pair sometimes stay to nest. In May 1938 I found a nest hole in the Karak Lora near Quetta, the site being given away by the mass of small bones and guano outside the hole. I found a similar nest hole in the mud bank of the Kaisar River near Nushki in April 1939. Both holes went in 3 ft. and the chamber measured 5"×4", and contained fish bones. In each case there were five eggs, averaging 23.4×20.3 mm.

26. *Merops orientalis beludshicus*.

This race of Little Green Bee-eater is sometimes seen at Chaman. I have not seen it anywhere else.

27. *Caprimulgus aegyptius aegyptius*.

The range of this Nightjar extends from the Sudan in winter to Seistan and Turkestan in summer. It is very light in colour, and has no white spots on the upper surface of the wings or tail. I obtained it at Robat on the Afghan-Iran-Baluchistan frontier on 12th April 1939, and saw another. Natives know it well and say it comes to nest there, but I could find no one who had seen its eggs. My specimen, a male, had wing 208 mm.

28. *Strix aluco biddulphi*.

I obtained a half-fledged Scully's Wood Owl in July 1940, but in spite of advice as to its feeding from Karachi Zoo, it only lived ten days. It was then three months old. Colonel Venning obtained an adult on 10th January some years ago, which is now in the Bombay Museum. No other records. Probably resident; tribesmen say it is the common owl of the chilghoza forests there, and that it nests under a large boulder.

29. *Haliaeetus albicilla*.

A very fine female frequented a Quetta rubbish dump a mile from cantonments for some days in the very cold February of 1940. It was very tame, and allowed one to approach within 10 yds. on horseback on several occasions. There was also a female at Kushdil Khan on 10th June 1940. No other records, though it has been reported occasionally from the coast.

30. *Falco peregrinus calidus*.

Lt.-Colonel O'Carrol Scott, M.B.O.U., a keen falconer, saw a Siberian Peregrine at Kushdil Khan on 11th February, 1940. I went there with him, and we tried to catch her, without success.

31. *Falco subbuteo subbuteo*.

I saw a pair at Ziarat on 20th July, 1939, and watched them for three days. Meinertzhagen recorded one there on 24th July 1913. Major Bedi, P. A. Loralai, a very knowledgeable falconer, saw one near Loralai in October, 1940.

32. *Falco jugger*.

The Lugger Falcon, a plains species, is very rare in N. Baluchistan. One pair nests regularly in the mud cliffs of the Malezai Lora, near Pishin. The nest is in a hole 20 ft. up, and in 1939 four eggs were laid on sticks in April. In 1940 the nest was moved to another hole a few yards away, and no sticks were used, the four eggs being deposited on the sand. From the opposite side of a small nala the eggs could be seen, and the young hatched successfully each year.

33. *Falco tinnunculus tinnunculus*.

The Asiatic race *tinnunculus* is a passage migrant through Chagai and the S.-W., and also a summer visitor in small numbers and breeds in the higher hills. A few over winter.

In April 1939 I was lucky enough to see a migration of Kestrels through Chagai. I followed them for 130 miles. They flew along the ground, now and again settling on small bushes, and then pushing on again. I counted between 50 and 60, and shot one, which proved to be the typical race. I also obtained it on the Iran border in March.

34. *Falco aesalon insignis*.

The Merlin is a scarce winter visitor mostly to the open parts of Loralai District. *Falco chicquera* does not occur.

35. *Accipiter nisus melanoschistus*.***Accipiter nisus nisosimilis*.**

The Himalayan race of Sparrow Hawk *melanoschistus* is darker and nearly an inch shorter than the Asiatic race *nisosimilis*. The former is a summer visitor, and breeds in the juniper forests in June, in small numbers. The latter is purely a scarce winter visitor.

36. *Circus aeruginosus*.

A winter visitor to Malezai and Zangi Nawar. Natives told me it bred in both places occasionally, and at Zangi Nawar showed me two old nests in dense patches of reeds. In 1940 a pair nested successfully in a dense reed bed at Malezai. Single non-breeding birds sometimes remain all summer.

37. *Streptopelia senegallus cambayensis*.***Streptopelia senegallus ermanni*.**

Two races of the Little Brown Dove occur; *cambayensis* is the common bird of Zhob, Loralai, Quetta-Pishin, Sibi and Kalat, its numbers being augmented both by passage migrants and summer visitors. It is smaller and darker than *ermanni*, and males have wings 125-132 mm. and females 121-129 mm. *Ermanni* is the race of Western Chagai, and I obtained it at Kacha and Robat on the Iran border. Wings of male 135-140 mm., females 130-140 mm.

38. *Fulica atra*.

In 1939 a Coot nested on Kushdil in a small reed patch and hatched out five young in the last week in June. A second brood of three was hatched from the same nest on 18th August. The only breeding record for Baluchistan.

39. *Megalornis grus*.

The typical race is recorded by Dr. Ticehurst as a passage migrant over Quetta, Kalat, and Mekran. *M. g. lilfordi* which nests in Eastern Siberia and winters in Northern and N.-W. India, winters at Zangi Nawar, where there is annually a flock of about fifteen, one of which I shot in 1939 to make sure.

40. *Otis tarda*.

In 1937 natives brought in alive a pair of Greater Bustards to the Political Agent at Nushki. These became very tame, and walked about the compound like turkeys. Unfortunately in 1938 they were killed by dogs. One was shot in the Zhob on 2nd April, 1940.

41. *Charadrius leschenaulti*.

I saw a small flock of six Geoffroy's Sand Plovers in March 1938, West of Quetta near the Afghan frontier, and five in the North Chagai desert on 21st April 1939, obtaining a bird in each case. Finn reports this species when on the Afghan Boundary Commission, 1896.

42. *Totanus nebularius*.

I saw a Greenshank that had been shot at Kushdil on 22nd June, 1939, and obtained one at Zangi Nawar on 25th February 1940. I saw what I took to be a small flock at Kushdil on March 17th 1938, but did not obtain one.

43. *Numenius arquata lineatus*.

In April one occasionally hears a Curlew's cry as it passes over Quetta. I have only seen three on the ground, one on 16th April 1939 at Burj Aziz Khan, near the Afghan frontier West of Quetta, one at Zangi Nawar on 23rd October 1939, and one at Kushdil on 6th October 1940, which I shot.

44. *Limosa limosa*.

All specimens of the Black-tailed Godwit obtained on passage are very large. Otherwise they are not distinguishable from the typical race. Eight birds shot in September and October measured as follows:—

3 males, Wing 206-212 mm.; Bill 105-110 mm.

5 females, Wing 230-250 mm.; Bill 116-126 mm.

45. *Lobivanellus indicus aigneri*.

I have seen small flocks of the Red-wattled Lapwing near Quetta on passage, and they winter regularly at Zangi Nawar. An odd pair is resident.

46. *Tringa erythropus*.

The Spotted or Dusky Redshank is a scarce but regular passage migrant through Kushdil Khan and Zangi Nawar. I have obtained it only in September and October.

47. *Capella solitaria*.

One Snipe was shot by me at Zangi Nawar on 23rd October 1938. Another near Quetta on 15th October 1939 and Pishin 1940. A very large race, wing average 166 mm.

48. *Larus fuscus taimyrensis*.

I saw a Lesser Black-backed Gull at Kushdil on April 17th 1938, July 18th 1938, and a small flock of a dozen on August 20th 1940. At Zangi Nawar I saw one on October 16th and 19th, 1940.

49. *Botaurus stellaris stellaris*.

The Bittern is a regular winter visitor to Zangi Nawar and Malezai; an odd pair must stay to breed, as on 8th June 1939 I put up two young ones hardly able to fly, from the Karak Lora near Quetta, and they bred at Malezai in 1914 and 1938.

50. *Ixobrychus minutus minutus*.

The Little Bittern is a common summer visitor to Malezai, where it breeds in some numbers. It arrives in April and leaves in August. Nests are in the reeds in 2-4 ft. of water, and 18 in. to 2 ft. above it, the nest itself being cup-shaped and made of dead reed stems plaited into standing ones, and 9 in. in diameter. It is built up solid from the water level. Five to seven eggs are laid, and incubation must start as each egg is laid, as the young are seen in various stages of growth. It also breeds near Nushki.

51. *Nycticorax nycticorax*.

The Night Heron breeds regularly in a colony in the Chenar avenue in Lytton Road, Quetta. I have not seen it anywhere else. They arrive in March and leave in July. The nests are only rough platforms of sticks, unlined, and high up. 3-5 eggs are laid in April, average 50×34.5 mm. The whole colony is very messy, and numbers of young birds fall out of the nests onto the road. As dusk falls the birds may be seen flying off to the adjacent loras to feed, but I have seen them fishing by day when young are being fed.

52. *Ardea purpurea*.

Both the European race *purpurea* and the Asiatic *manillensis* visit us spasmodically. Meinertzhagen reports records from Quetta and Nushki in March. I got *purpurea* in the Karak Lora, near Quetta, on 12th March, 1938, and at Zangi Nawar on 17th October 1940.

53. *Cygnus olor*.

Mute Swans visited Kushdil Khan in November 1933, and January and February 1935 (Quetta Shooting Club Records). I saw five at Zangi Nawar on 23rd October 1939. Four were shot near Bostan 20 miles North of Quetta in 1900 by a platelayer, and Meinertzhagen records them at Kushdil in February 1911 and November 1913.

54. *Anser indicus*.

There were three Bar-headed Geesè at Zangi Nawar on 5th October, 1938. No other record.

55. *Oxyura leucocephala*.

The Stiff-tailed Duck is a rare but regular winter visitor to Kushdil and Zangi Nawar. One has been shot at each place in December 1938, 1939, and 1940. All birds of the year.

56. *Tadorna tadorna*.

In 1937 a pair of Shelducks bred in a hole opposite the island on Kushdil, and hatched out eleven, which the parents took over to the island. Seven were shot in September and October. In 1939 a pair nested at the N.-E. end and young birds were shot on 15th October and 12th November. An adult male was shot on 23rd November 1940, and I saw one shot at Zangi Nawar on 4th November 1939.

57. *Anas angustirostris*.

I have tried to get evidence of the Marbled Duck nesting at Zangi Nawar. Natives are positive it breeds there in small numbers, and they take the eggs. The terrific heat in May and June prevented me from finding a nest when I went there for that purpose. There is no reason why it should not breed there.

58. *Glaucion clangula*.

The Golden-eye is one of the rarest of the ducks seen in Baluchistan. The only one I have seen was shot at Kushdil on 12th December, 1940. Two specimens obtained at Zangi Nawar in January 1916 were in the Old Quetta Museum.

59. *Clangula hyemalis*.

A female Long-tailed Duck was shot at Kushdil in January 1938, and identified by the Society. The only record.

60. *Merganser merganser orientalis*.

The Eastern Goosander is a very irregular winter visitor to Kushdil and Zangi Nawar. I saw one shot at Kushdil in November 1938 and myself shot one at Zangi Nawar on 2nd December 1939. Both were birds of the year. No other records.

61. *Mergus serrator*.

Red-breasted Mergansers were shot at Kushdil on 17th February 1934 and 19th November 1939. Both were birds of the year. There is an old record on 3rd April 1902.

ADDENDUM.

Pericrocotus brevirostris.

On 27th June 1942 I found a family party of Short-billed Minivets on Shinghar the first record for Baluchistan.

GONIOZUS INDICUS ASH.—A NATURAL ENEMY OF THE
SUGARCANE WHITE MOTH BORER (*SCIRPOPHAGA*
RHODOPROCTALIS).

BY

M. C. CHERIAN, B.A., B.SC., D.I.C., AND P. ISRAEL, M.A.

Agricultural Research Institute, Coimbatore.

INTRODUCTION.

During the course of investigations on *Scirpophaga*, seven larval parasites have been noted by the authors. The results of the studies of four of them, viz., *Elasmus zehntneri* Ferr., *Stenobracon nicevillei* Bingh., *Rhaconotus scirpophagae* Wlk., and *Stenobracon deesae* Cam., have already been published (Cherian and Israel, 1937, 1938). *Goniozus indicus* which forms the subject matter of the present paper belongs to the family Bethyilidae. The parasite was observed by the authors for the first time in South India in March 1936 in *Scirpophaga* attacked sugarcane stems and, later on, it was also collected on *Chilo zonellus* Swinh. in Sorghum.

LIFE HISTORY OF THE MOTH BORER.

A brief account of the nature of damage caused by the moth borer and its habits is given here so that the relationship between the host and the parasite can be better understood. The damage caused by the moth borer both to the young and grown up canes is serious. The characteristic buff-coloured egg mass of the moth is generally laid on the undersurface of the leaves and the larvae on hatching find their way into the leaf roll and tunnel downwards and destroy the growing point of the plant. When full grown, it makes a short tunnel to the outside, at right angles to the original tunnel, the exit hole being closed with a thin film of the outermost leaf sheath. As it withdraws itself into the tunnel, it spins partitions of silk, one behind the other and pupates in the tunnel. It takes 2-2½ months for the pest to complete its life cycle.

DESCRIPTION OF THE PARASITE.

The description of the parasite as given by Ashmead (1903) is:

'Female—length 2.5 to 3 mm. Black and shining, the head with some small, sparse, scattered punctures, the pronotum very delicately and microscopically shagreened, the parapsidal furrows not indicated, the metathorax feebly reticulate with irregular microscopic lines at the sides, the antennae and the legs, except the coxae, anterior femora above and the middle and hind femora except at tips, honey-yellow, the anterior femora above and the middle and hind femora being embrowned or black; the extreme apex of the dorsal abdominal segments 2 to 4 are usually more or less jointly testaceous, while the wings are hyaline, the veins more or less yellowish, the stigma and parastigma being brown.'

Muesebeck (1940) has subsequently described the species in greater detail under the impression that Ashmead's description was still in manuscript,

HABITS OF THE WASP.

The adult parasite crawls out by cutting a small hole in its cocoon and when the exit to the outside is found closed by the lid constructed by the host on the outermost leaf sheath, it cuts a hole in this lid and escapes through it. Table I gives the number of parasites reared out from host larvae collected from the field. It is seen from the table that out of 300 adults which emerged from 15 cocoon spindles the number of females was 267, the percentage being 89. In the rearings at the Insectary also, the proportion of females was about the same (81%). On an average, about 20 adults emerged from each host larva, the maximum and minimum being 32 and 9 respectively.

The adult avoids light, and immediately after emergence seeks hiding places. When supplied with a sugarcane stem with a host larva, it commences to prod with extended antennae and finally locates the lid made from the outermost leaf sheath. It easily perforates this lid and enters the larval tunnel. It then crawls about on the larva and paralyses it. When the larva is completely paralysed the parasite begins to lay its eggs. The eggs are laid on the dorsal, ventral and lateral sides of the body but oftener on the ventral and lateral sides. They are laid singly one after the other at an interval of 2-5 minutes and generally laid in the folds of the intersegmental groove while the eggs lie parallel to the groove itself. The eggs are laid along with a slimy fluid, which later on hardens, making the egg stick firmly to the body of the host. When all the eggs are laid the parasite retreats amidst the frass which fills the tunnel and there it lives the rest of the time and then dies. If the host larva happens to be young and has not constructed any external lid the parasite enters through the leaf spindle from the top and reaches the host making its way through the tunnel packed with frass. The passage through the frass is by no means easy and the parasite often dies on its way to the host. Generally, 9-40 eggs are laid on each host. A study of Table II reveals that the parasite has not the habit of distributing its eggs. When once it enters a larval tunnel and deposits its eggs on the larva, it never seeks another host, even if it be near by. But, in the laboratory, it has been found that if the parasite after laying its eggs on a host, is removed and given another host, it may lay more eggs on it.

As a result of a series of experiments it has been found that (1) eggs are laid by a parasite only on one host even if more are supplied, (2) if one host alone is supplied to a number of parasites they attack the host simultaneously and lay eggs on it, (3) if different species of borers are given to a single parasite it prefers the one in which the host is easily accessible, (4) the parasite breeds parthenogenetically, the progeny in such cases being males, and (5) the parasite never attacks the host pupa.

LIFE HISTORY.

The egg is glistening white in colour, translucent, elongate cylindrical and rounded off at the two extremities and measures 1 mm. The egg period ranges from 2-3 days.

The newly hatched grub measures $1 \times \frac{1}{2}$ mm. After hatching, the grub does not change its position but sticks to the body of the host and begins to suck its juices on account of which it acquires the color of the host. When the larva is completely eviscerated, small, circular, black dots are seen on the larval skin which indicate the places of punctures made by the parasite grubs to draw the internal contents of the host. In 3-5 days the grub reaches its maximum size of 5×3 mm. At this stage, it spins a brown cocoon which measures 8 mm. within which it pupates. These cigar-shaped cocoons are attached to one another and the cocoon spindle runs throughout the tunnel. The larval period ranges from 3-5 days.

3-6 days after the formation of the cocoon, the grub inside pupates. The pupa, when fresh, is white, but in about two days it turns black. It measures 5×2 mm. The pupal period ranges from 4-7 days.

DURATION OF THE LIFE CYCLE.

The total life cycle of the parasite ranges from 14-19 days, the average for 30 cases being 16 days. Table III gives the detailed life history records of the parasites.

LONGEVITY OF THE ADULT WASPS.

The maximum longevity for a female was 48 days and for a male 4 days, the average being 20 and 2 days respectively. Table IV gives the longevity records of 7 males and 17 females.

SEASONAL AND REGIONAL PREVALENCE.

Field observations on the incidence of the parasite show that the attack of the parasite on *Scirpophaga* is noticed in large numbers from February to April. In May and June, there is only a slight attack. But the parasite breeds continuously throughout the year on *Chilo zonellus* Swinh. in Sorghum.

EFFICACY OF *Goniozus indicus* AS A PARASITE.

The short life cycle of the parasite when compared with that of the pest and the ease with which it can be bred in the laboratory are points in its favour. The fact that the parasite attacks only one host in its life time is however a drawback. Further it is not a specific parasite in that it also attacks *Chilo zonellus* Swinh.

ACKNOWLEDGMENTS.

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TABLE I

Statement showing the number of parasites-emerged from each host larva collected from the field

Serial No.	Total No. of adults	No. of females	No. of males	Date of Emergence
1	19	18	1	13-4-36
2	17	16	1	27-4-36
3	32	28	4	1-5-36
4	28	25	3	2-5-36
5	20	18	2	10-5-36
6	24	20	4	28-5-36
7	17	15	2	10-7-36
8	18	15	3	3-4-37
9	22	20	2	3-4-37
10	22	19	3	26-4-37
11	11	10	1	14-5-37
12	9	8	1	7-6-37
13	19	16	3	25-6-37
14	28	26	2	25-6-37
15	14	13	1	26-6-37

Average number of adults emerged from host 20,

TABLE II

Oviposition records of *Goniozus indicus*

Serial No.	Emergenced on	1st Batch		2nd Batch		Died on	Total No. of eggs
		Laid on	No. of eggs	Laid on	No. of eggs		
1	26-3-36	28-3-36	10	29-3-36	3	15-4-36	13
2	11-4-36	12-4-36	9	15-4-36	28	21-4-36	37
3	11-4-36	22-4-36	22	24-4-36	11	30-4-36	33
4	11-4-36	16-4-36	39			19-4-36	39
5	11-4-36	15-4-36	21			17-4-36	21
6	11-4-36	16-4-36	37	22-4-36	15	29-4-36	52
7	11-4-36	19-4-36	17	20-4-36	18	30-4-36	35
8	11-4-36	19-4-36	41			23-4-36	41
9	11-4-36	20-4-36	13			22-4-36	13
10	2-5-36	6-5-36	20			13-5-36	20
11	5-5-36	7-5-36	29	14-5-36	9	20-5-36	38
12	5-5-36	25-5-36	27	30-5-36	11	4-6-36	38
13	20-6-36	23-6-36	28			25-6-36	28
14	10-7-36	19-7-36	21	23-7-36	18	23-7-36	39
15	12-3-37	20-3-37	21			31-3-37	21
16	12-3-37	20-3-37	18	21-3-36	9	27-3-37	27
17	12-3-37	20-3-37	36			30-3-37	36
18	12-3-37	20-3-37	28			31-3-37	28
19	3-4-37	11-4-37	38			12-4-37	38
20	3-4-37	8-4-37	40			9-4-37	40
21	3-4-37	13-4-37	21			18-4-37	21
22	3-4-37	8-4-37	30			15-4-37	30
23	3-4-37	11-4-37	26	14-4-37	14	16-4-37	40
24	26-4-37	30-4-37	23			1-5-37	23
25	26-4-37	30-4-37	19	6-5-37	13	8-5-37	32
26	16-5-37	23-5-37	24			28-5-37	24
27	16-5-37	29-5-37	33			31-5-37	33
28	7-6-37	10-6-37	24	14-6-37	9	19-6-37	33
29	7-6-37	13-6-37	28			20-6-37	28
30	25-6-37	4-7-37	16			6-7-37	16

TABLE III
Detailed life-history record of *Goniozus indicus*.

S. No.	Eggs laid on	Larva hatched on	Egg period in days	Cocoon formed on	Active larval life	Pupated on	Total larval period	Adults emerged on	Pupal period	Total life cycle
1	28-3-36	31-3-36	3	4-4-36	4	9-4-36	9	13-4-36	4	16
2	29-3-36	1-3-36	3	4-4-36	3	9-4-36	8	13-4-36	4	15
3	12-4-36	14-4-36	2	19-4-36	5	23-4-36	9	27-4-36	4	15
4	15-4-36	17-4-36	2	20-4-36	3	26-4-36	9	1-5-36	5	16
5	16-4-36	19-4-36	3	22-4-36	4	26-4-36	7	1-5-36	5	15
6	16-4-36	19-4-36	3	23-4-36	4	28-4-36	9	2-5-36	4	16
7	19-4-36	21-4-36	2	25-4-36	4	29-4-36	8	5-5-36	6	16
8	20-4-36	22-4-36	2	26-4-36	4	1-5-36	9	7-5-36	6	17
9	22-4-36	24-4-36	2	19-4-36	5	3-5-36	9	8-5-36	5	16
10	23-4-36	25-4-36	2	29-4-36	4	4-5-36	9	10-5-36	6	17
11	24-4-36	27-4-36	3	1-5-36	4	6-5-36	9	10-5-36	4	16
12	24-4-36	27-4-36	3	30-4-36	3	4-5-36	7	10-5-36	6	16
13	6-5-36	8-5-36	2	12-5-36	4	17-5-36	9	22-5-36	5	16
14	7-5-36	9-5-36	2	12-5-36	3	17-5-36	8	22-5-36	5	15
15	11-5-36	14-5-36	3	19-5-36	5	23-5-36	9	28-5-36	5	17
16	25-5-36	28-5-36	3	2-5-36	5	6-6-36	9	10-6-36	4	16
17	25-5-36	27-5-36	2	31-5-36	4	5-6-36	9	10-6-36	5	16
18	30-5-36	2-6-36	3	5-6-36	3	10-6-36	8	15-6-36	5	16
19	23-6-36	26-6-36	3	30-6-36	4	7-7-36	11	12-7-36	5	19
20	23-7-36	26-7-36	3	29-7-36	3	3-7-36	8	10-7-36	7	18
21	20-3-37	22-3-37	2	25-3-37	3	30-3-37	8	3-4-37	4	14
22	20-3-37	22-3-37	2	25-3-37	3	31-3-37	9	4-4-37	4	15
23	21-3-37	24-3-37	3	28-3-37	4	2-4-37	9	7-4-37	5	17
24	11-4-37	13-3-37	2	16-4-37	3	22-4-37	9	26-4-37	4	15
25	29-4-37	1-5-37	2	5-5-37	4	9-5-37	8	14-5-37	5	15
26	30-4-37	2-5-37	2	6-5-37	4	13-5-37	8	16-5-37	6	16
27	23-5-37	25-5-37	2	28-5-37	3	31-5-37	6	7-6-37	6	14
28	29-5-37	31-5-37	2	3-6-37	3	7-6-37	7	13-6-37	6	15
29	9-6-37	11-6-37	2	14-6-37	3	19-6-37	8	25-6-37	6	16
30	10-6-37	12-6-37	2	15-6-37	3	20-6-37	8	26-6-37	6	16

Average Total ... 16

TABLE IV

Longevity of *Goniozus indicus*

S. No.	Emerged on	Died on	No. of days lived
1	26-3-36	15-4-36	20
2	11-4-36	26-4-36	45
3	11-4-36	19-4-36	38
4	11-4-36	29-4-36	48
5	2-5-36	13-5-36	42
6	5-5-36	20-5-36	46
7	5-5-36	6-5-36	1
8	11-5-36	12-5-36	1
9	5-8-36	10-8-36	5
10	12-3-37	14-3-37	2
11	12-3-37	15-3-35	3
12	12-3-37	21-3-37	9
13	12-3-37	30-3-37	18
14	3-4-37	8-4-37	5
15	3-4-37	9-4-37	6
16	3-4-37	12-4-37	9
17	3-4-37	18-4-37	15
18	3-4-37	15-4-37	12
19	3-4-37	16-4-37	13
20	11-4-37	14-4-37	3
21	26-4-37	8-5-37	12
22	26-4-37	1-5-37	5
23	26-4-37	30-4-37	4
24	26-4-37	27-4-37	1

MEDICINAL AND POISONOUS MALLOWWORTS.

BY

J. F. CAIUS, S.J., F.L.S.

PART II.

(Continued from page 241 of this volume).

KYDIA

The genus consists of 2 species, both Indian.

Kydia calycina Roxb. is common in the forests of the sub-tropical regions of India and Burma, except the arid tracts.

Among the Santals, the leaves are pounded and made into a paste and applied to the body for pains. They are also chewed, when there is a deficiency of saliva (Campbell).

Almora : Pata—; *Amraoti* : Bhoti—; *Assam* : Boldabak—; *Bhil* : Bothi—; *Bihar* : Bitagonyer—; *Bijnor* : Palao, Pattra—; *Bombay* : Motipotari, Varanga, Varangada, Varung—; *Buldana* : Bhoti—; *Burma* : Bokemaiza, Dwabote, Dwalok, Myethlwa, Tabo—; *Canarese* : Belagu, Bellaka, Bende, Bendenaru, Bendi, Billulhendi, Kadubende, Kolibnde, Nayibende—; *Central Provinces* : Baranga, Bargha, Bhoti—; *Garhwal* : Pillu, Pulao—; *Garro* : Boldobak—; *Gond* : Bosha, Burkapa, Buruk, Kunji—; *Gujerati* : Mhotihirwani Nihotiliwani—; *Hasada* : Bitabororo—; *Hindi* : Baranga Choupultea, Pasha, Pola, Potari, Puja, Puli, Pulipasha, Pulu—; *Kharwar* : Derki—; *Khond* : Wala—; *Kolami* : Bitagoinr, Bittia, Gonyer, Pata-dhamin—; *Konkani* : Varang—; *Lambadi* : Charpili—; *Lepcha* : Sedangtaglar, Ta-gla kung hlosa—; *Malayalam* : Velukku, Venta—; *Marathi* : Bhendi, Bhoti, Iliya, Potari, Varung—; *Matheran* : Bhoti, Potasi, Warung—; *Mechi* : Mahow, Moshungon—; *Melghat* : Bhoti—; *Nepal* : Kubinde—; *Nimar* : Safed dhaman—; *North-Western Provinces* : Puta, Puttiya—; *Oudh* : Kakahi—; *Porebunder* : Mhotihirwani—; *Punjab* : Pola, Pula, Pulli—; *Ramnagar* : Pula—; *Sadani* : Baranga, Bicra, Jhari—; *Santal* : Poshkaolat, Poskaolat—; *Saora* : Erukutada, Pulan—; *Shan* : Dwabok—; *Sinhalese* : Pule—; *Tamil* : Vendai—; *Telugu* : Kondapotari, Pachabotuka, Pandiki, Peddakunji, Peddapotari, Potari—; *Tharu* : Patar—; *Uriya* : Bankopasia, Bharimo, Khopashya—.

MALACHRA.

The genus consists of 6 species, natives of the warmer regions of America, and of the West Indies. Two of them are naturalized in Asia and Africa.

Malachra capitata Linn., a native of tropical America, is found throughout the hotter parts of India where it has become naturalized.

In La Reunion the plant is used as an emollient and pectoral. It is a popular cough remedy in Mauritius.

Bombay : Ranbhendi—; *Marathi* : Ranbhendi, Vilayatibhendi—; *Mauritius* : Mauve à fleurs jaunes—; *Porebunder* : Pardeshibhindo—; *Sunderbuns* : Ban bhindi, Bandheras—.

MALVA

The genus numbers 30 species inhabiting temperate Europe and Asia, and North Africa.

All species are remarkable for their mucilaginous and cooling properties.

The following are used medicinally in Europe—*M. Alcea* Linn., *M. althaeoides* Cav., *M. hispanica* Linn., *M. moschata* Linn., *M. nicaeensis* All., *M. parviflora* Linn., *M. rotundifolia* Linn., *M. sylvestris* Linn., *M. Tournefortiana* Linn.—; in China—*M. verticillata* Linn.—; in Indo-China—; *M. sylvestris* Linn., *M. verticillata* Linn.—; in North America and the West Indies—*M. moschata* Linn., *M. parviflora* Linn., *M. rotundifolia* Linn., *M. sylvestris* Linn.—; in Colombia—*M. sylvestris* Linn.—; in Madagascar—*M. crispata* Linn.—; in La Reunion—*M. parviflora* Linn., *M. sylvestris* Linn.—; in Southern Africa—*M. parviflora* Linn., *M. rotundifolia* Linn.—.

1. Carpels 10-12 enclosed within the accrescent calyx, prominently ribbed at the back. *M. verticillata*.
2. Carpels 13-16 not reticulated on the back, the margins of the back rounded. *M. rotundifolia*.
3. Carpels about 10-12, 2-keeled on the back *M. sylvestris*.
4. Carpels 10, reticulated on the back, the 2 margins of the back keeled. *M. parviflora*.

1. **Malva parviflora** Linn. occurs in Bengal, the United Provinces, Kashmir, the Punjab, Baluchistan, Sind, the Bombay Deccan, Mysore and Madura. It is distributed through Afghanistan, Persia, the Mediterranean region, Arabia, Nubia.

The seeds are used as a demulcent in coughs, and ulcers in the bladder.

In La Reunion the plant is used as an emollient and pectoral.

In South Africa Europeans drink an infusion of the leaf as a nerve tonic, and apply the leaf as a hot poultice to wounds and swellings. The Xosas have a similar use to the latter, and often use a decoction as a lotion.

The Sutos use the decoction of the leaf as a remedy for tape-worm and for profuse menstruation. They also make a lotion for bruised limbs from the plant.

Afrikaans: Kasiëblaar, Kiesieblaar—; *Arabic*: Bekoul—; *Egypt*: Esh-sheytaniyeh, Khobbeyze, Khobbeyzeh—; *Iraq*: Khubbaz—; *Kurdish*: Tulakah—; *Kuwait*: Khubaiz—; *Makran*: Guragpad—; *Mexico*: Malva—; *North America*: Mallow—; *Punjab*: Gogisag, Nanna, Narr, Panirak, Sonchal, Supra—; *Sinaloa*: Malva castilla—; *South Africa*: Mallow—; *Spanish*: Chica malva de flor, Pequeña malva de flor—; *Suto*: Mosalasuping, Qena, Thibapitsa, Tikamotse—; *Turkish*: Tulah—; *Xosa*: aNomolwana—; *Waziri*: Ngankai, Tikalai—.

2. **Malva rotundifolia** Linn. occurs in Sind, Baluchistan, Waziristan, Kumaon, ascending to 10,000 feet, and in the plains of Northern India. It is distributed through the Oriental regions, Europe, and North Africa.

The leaves are mucilaginous and emollient, employed externally in scurvy, and reckoned useful in piles (Honigberger).

The seeds possess demulcent properties; they are prescribed in bronchitis, cough, inflammation of the bladder, and haemorrhoids; the seeds are also externally applied in skin diseases.

At Hindubagh, in Baluchistan, the plant is used as a cooling drug. At Kalat the plant is ground up, soaked in water, mixed with sweetmeat, and drunk to relieve retention of urine.

In the Transvaal, Europeans apply a poultice of the leaf in inflammations of the breast.

The leaf has been used in Europe and America, in the form of an infusion or a decoction, for catarrh, dysenteries, and nephritis. As decoction, fomentation, or poultice, it is given in sore throat and ophthalmia, or for maturing abscesses.

Afrikaans: Kiesieblaar—; *Arabic*: Gobhaiz, Honzebey, Khobeiz, Khubbaizi, Roboueiz—; *Baluchi*: Gwaragpad, Pochako—; *Brahui*: Uter—; *Canarese*: Kadukadalegida—; *Catalan*: Malva de fulla petita, Malva petita de fulla rodona—; *Danish*: Lille Katost—; *Dutch*: Rundbladige maluwe—; *English*: Cheese Cake Flower, Dwarf Mallow—; *French*: Fromageon, Fromagère, Herbe de Simon, Mauve à feuilles rondes, Mauve ronde, Menthe de cimetière, Petite mauve—; *German*: Kaesepappel—; *Harboi Hills*: Fochako—; *Hindi*: Khubasi, Sonchala—; *Hindubagh*: Sarkukar—; *Italian*: Malva comune, Malva minore—; *Kalat*: Uthpar—; *Kharan*: Pachko—; *Languedoc*: Malbré—; *Portuguese*: Malva—; *Pushtu*: Kukerai—; *Roumanian*: Casui popei, Nalba marunta, Nalba mica—; *Sind*: Chandiri, Khabazi—; *South Africa*: Dwarf Mallow, Mallow—; *Spanish*: Malva de hoja redonda—; *Telugu*: Trikalamalli—; *Waziri*: Naghankai, Nahan-kai, Wahankai—.

3. *Malva sylvestris* Linn. is found in the West temperate Himalaya from the Punjab to Kumaon, at an altitude of 2,000—8,000 feet. It is met with as a weed of cultivation in Bombay, Mysore and Madras. It is distributed to Siberia, the Caucasus, Europe, and North Africa.

The plant is a popular demulcent and emollient with Muhammadan physicians. It is used for coughs and colds, and in affections of the urinary bladder.

In Teheran the drug—flowers with the small rotate carpels of the fruit in an immature state—is used for whooping cough.

Afghanistan: Gulikhadmi—; *Arabic*: Bekoul, Khitimi, Khubaji Kobbeiza, Moudjdjir, Ouerd-ez-zoual—; *Bombay*: Khubasi—; *Canarese*: Sannabindigegida—; *Catalan*: Malva de cementiri, Malva comuna, Malva major—; *Colombia*: Malva, Malva azul—; *Danish*: Katost—; *Deccan*: Vilayati kangoie—; *Dutch*: Kaasjeskruid, Maluwe, Malve—; *Egypt*: Khobbeize frengiye—; *English*: Blue Mallow, Bread-and-Cheese, Cheese-cake, Cheese Log, Cheese-flower, Chock-cheese, Chucky-cheese, Common Mallow, Country Mallow, Custard Cheeses, Dock, Frog-cheese, Ground Dock, High Mallow, Loaves-of-Bread, Mallow, Marsh Mallow, Maul, Maws, Pancake Plant, Pick Cheese—; *French*: Beuret, Beurrat, Fouassier, Fromagelet, Fromageon, Fromageot, Herbe à fromage, Herbe à lâcher, Herbe Saint-Simon, Maule, Mauve, Grande mauve, Mauve officinale, Mauve sauvage, Mauve verte, Mauve de ville, Meule—; *German*: Baerwinde, Blauglockel, Blau-malve, Feldmalve, Feldpappel, Feldriss, Feldwinde, Fuenfaderkraut, Gaense-laetsche, Gaensepappel, Hanfpappel, Hanfwurzel, Kaselskraut, Katzenkaese, Katzentee, Kesselkraut, Kornwinde, Malve, Milzkraut, Papelle, Papellkraut, Pappelkaese, Pferdepappel, Rossmalve, Rosspappel, Schwellkraut, Schwoilkraut, Siegmarskraut, Toepel, Waldmalve, Wewinne, Blaue Winde, Ziegerli, Zwischenkraut—; *Greek*: Malachi—; *Hindi*: Vilayatikangai—; *Hungarian*: Malyva, Papsajt—; *Indo-China*: Cam quy—; *Italian*: Malva, Malvone—; *La Reunion*: Mauve—; *Malta*: Common Mallow, Malva, Hobbeiza—; *Mauritius*: Mauve de France—; *North America*: Common Mallow, Doll-cheeses, Dutch-cheese, Fairy-cheeses, Low Mallow, Mallow—; *North-Western Provinces*: Kanji,

Tilchuni—; *Patna*: Khatmi—; *Persian*: Khib-bazi, Khitmiikuchak, Khubazi, Nanakillagah, Nanikulagh, Penirek, Towdrie—; *Polish*: Slaz ziele—; *Portuguese*: Malva, Malva ordinaria—; *Roumanian*: Nalba—; *Russian*: Lyesnaia malva, Prosvirka—; *Sind*: Khabaji—; *Spanish*: Malva, Malva comun, Malva lisa, Malva silvestre, Malva yedra—; *Sussex*: Maller—; *Swedish*: Katost—; *Teheran*: Pasurak—; *Turki*: Hamam komandji—; *Turkish*: Ebegumeci—; *Urdu*: Khubaji—; *Waziristan*: Chota gul kharru—.

4. **Malva verticillata** Linn. occurs in the temperate Himalaya up to 12,000 feet. It is distributed to Northern Asia, Northern Africa, and Europe.

In Indo-China the root is used to produce vomiting in whooping-cough. The leaves and young stems are considered digestive and they are given to women in the advanced stage of pregnancy. The ash of the dried leaves is employed in the preparation of a drink which is given in scabies.

Assam: Laffa—; *Chinese*: K'uei—; *Indo-China*: Dong quy—.

MALVASTRUM

The genus consists of about 60 American and South African species, two of them cosmopolitan in the tropics.

M. coromandelianum Garcke is used medicinally in the West Indies, *M. spicatum* A. Gray in French Guiana, *M. coccineum* A. Gray in North America, *M. peruvianum* A. Gray in Colombia.

Malvastrum coromandelianum Garcke is found in the Madras and Bombay Presidencies, the Punjab and the United Provinces, Orissa and Bengal.

In the West Indies the plant is considered emollient, resolvent, and bechic. The leaves are applied to inflamed sores and wounds as a cooling and healing salve. The flowers are given as a pectoral and diaphoretic.

French Guiana: Ouadé-ouadé—; *Mauritius*: Herbe à balais, Mauve sauvage—.

PAVONIA

The genus numbers 70 species inhabiting tropical and subtropical regions.

The following species are used medicinally in Gambia—*P. zeylanica* Cav.—; in La Reunion—*P. columella* Cav., *P. urens* Cav.—; in Madagascar—*P. Bojeri* Baker, *P. macrotis* Baker—; in Brazil—*P. diuretica* St. Hil.—; in West Tropical Africa—*P. hirsuta* Guill and Perr.—; in Somaliland—*P. propinqua* Garcke—.

Involucral bracts 8-14, subulate.

1. Ripe carpels unarmed wingless. Leaves slightly lobed *P. odorata*.
2. Ripe carpels glabrous, narrowly winged. Leaves deeply lobed *P. zeylanica*.
3. Ripe carpels with 2 short prickless. Leaves oblong creneate *P. propinqua*.

1. **Pavonia odorata** Willd. is found in North-West India, Bundelkhand, Sind, Baluchistan, West Rajputana, Bengal, Konkan, Southern Maratha Country, North Circars, Deccan, Carnatic, Ceylon. It extends to East tropical Africa.

The fragrant root is esteemed by Ayurveda practitioners, who consider it aromatic, cooling, and stomachic. It is much used, in combination with other drugs, as a remedy for fever, inflammation, and haemorrhage from internal organs. It is a well-known South-Indian febrifuge. In Bombay it is prescribed as an astringent and tonic in cases of dysentery.

In Las Bela the plant is used as a cure for rheumatism.

Bombay: Kalavala—; *Canarese*: Balarakkasigida, Mudivala—; *Gujerati*: Kalowalo—; *Hindi*: Sugandhabala—; *Jodhpur*: Chirikenahl—; *Las Bela*: Zordar—; *Malayalam*: Kuruntotti—; *Marathi*: Kalavala, Sughandabala—; *Sanskrit*: Ambunamaka, Bala, Barhishttha, Haribera, Hrivela, Kachamoda, Keshanama, Keshanamaka, Keshya, Kuntala, Kuntaloshira, Lalanapriya, Toya, Udichya, Vajra, Vala, Valaka, Varapinga, Vari, Varida, Varinamaka—; *Sinhalese*: Pushpa-bevila—; *Tamil*: Avibattam, Peramutti, Suvesagam—; *Telugu*: Chittibenda, Ettakuti, Muttavapulagamu, Tigebenda—.

2. **Pavonia propinqua** Garcke is found in Sind and Baluchistan; it is distributed to Abyssinia and Somaliland.

In Somaliland a decoction of the leaves and branchlets is used as a wash, in the form of either a bath or a douche, to prevent abortion in syphilitic women.

Somali: Brumó—.

3. **Pavonia zeylanica** Cav. is found in Northern India, West Rajputana, Sind, the Western Peninsula, the Circars, Carnatic, and Ceylon. It is distributed to tropical Africa, and Mauritius.

The plant is a South Indian febrifuge.

In Gambia the plant is used as a vermifuge and a purgative by the Mandingo natives.

Canarese: Antutogari, Balarakshasi, Chittamutti—; *Mandingo*: Ratach—; *Sinhalese*: Gasbeuila—; *Tamil*: Kurundotti, Mammatti, Sevagan, Sittamutti—; *Telugu*: Chinnamutavapulagamu, Chinnamutennu, Karubenda, Peramutti—.

SIDA.

This genus includes 120 cosmopolitan species.

The roots of the different species are regarded as cooling, astringent, and tonic.

The following are used medicinally in the Canary Islands—*S. rhombifolia* Linn.—; in West Tropical Africa—*S. acuta* Burm., *S. cordifolia* Linn., *S. linifolia* Cav., *S. rhombifolia* Linn.—; in La Reunion—*S. acuta* Burm., *S. cordifolia* Linn., *S. rhombifolia* Linn.—; in Madagascar—*S. rhombifolia* Linn.—; in Southern Africa—*S. cordifolia* Linn., *S. longipes* E. Mey.—; in Indo-China—*S. acuta* Burm.—; in the Philippine Islands—*S. acuta* Burm., *S. rhombifolia* Linn.—; in Australia—*S. rhombifolia* Linn.—; in Central and South America—*S. paniculata* Linn., *S. viscosa* Linn.—; in Brazil—*S. acuta* Burm., *S. multiflora* Cav., *S. rhombifolia*

Linn.—; in North America—*S. obliqua* Nutt., *S. paniculata* Linn., *S. rhombifolia* Linn.

- A. Prostrate trailing herb ... *S. veronicaefolia*
- B. Erect or suberect, herbs or undershrubs. Stellately hairy
 - 1. Petiole spiny at the base ... *S. spinosa*.
 - 2. Petiole not spiny at the base
 - a. Awns exceeding the calyx ... *S. cordifolia*.
 - b. Awns short.
 - i. Leaves linear lanceolate, glabrous or nearly so *S. acuta*.
 - ii. Leaves rhomboid-lanceolate or obovate, hoary beneath ... *S. rhombifolia*.
 - iii. Leaves oblong-ovate obtuse, downy on both surfaces ... *S. grewioides*.

Sida acuta Burm. is generally distributed throughout the hotter parts of India. It is found all over the tropics.

The root is regarded as cooling, astringent, tonic and useful in nervous and urinary diseases, and also in disorders of the blood and bile. It is intensely bitter, and is prescribed in infusion, and in conjunction with ginger, in cases of intermittent fever. It is considered by the Hindu practitioners as a valuable stomachic and useful remedy in chronic bowel complaints; the dose, a small tea-cupful, twice daily.

The authors of the Bengal Dispensary, after a trial of the roots, were unable to satisfy themselves as to its febrifuge action, but it was found to promote perspiration, to increase the appetite, and to act as a useful bitter tonic. In Goa, the Portuguese value it as a diuretic, especially in rheumatic affections. They also use it as a demulcent in gonorrhoea, and Muhammadans believe this to have aphrodisiac properties.

In the Konkan, the root is applied with sparrow's dung to mature boils.

In Southern India the leaves, made warm and moistened with a little gingelly oil, are employed to hasten suppuration. In the Konkan they are applied with other cooling leaves in ophthalmia. In Bengal, the expressed juice is used in the form of an electuary in the treatment of intestinal worms.

In West Tropical Africa the leaves are sometimes an ingredient in prescriptions for intestinal worms in horses. They are used frequently by native witch doctors to procure abortion.

A cold infusion of the leaves is a common Yoruba remedy for gonorrhoea, and they are sometimes taken medicinally cooked with rice or other food. Rubbed up with water, they are used to scrub the body and as a wash for dogs, goats, etc., for scab and parasitic skin diseases. The bitter bark in infusion is taken as an appetiser and stomachic tonic.

In Gold Coast the plant is used to cure venereal disease. The leaves when bruised are slimy and are put on the hands of midwives when they are about to remove dead children from the womb; they are mashed in water and the liquid used as an enema for paralysed children to help them to walk; they are frequently used to cause abortion.

Sanskrit writers recommend the plant in combination with other drugs for the treatment of snake-bite and scorpion-sting. But Caius and Mhaskar have proved experimentally that the plant is not an antidote to either snake or scorpion venom.

Andamans: Sirivadibbila—; *Ashanti*: Sowa—; *Awuna*: Xa-gbe—; *Bengal*: Bonmeshi, Pilabarelashikar, Shvetberelakoreta—; *Bombay*: Bala, Janglimeshi—; *Brazil*: Maiva, Vassoura—; *Burma*: Katsaynai, Pyendangnaen—; *Canarese*: Bhimankaddi, Vishakaddi—; *Ceylon*: Malaitanki, Vaddatiruppi, Vishapati—; *Deccan*: Isarbadi, Isbadi—; *Ewe*: Ademe-ademe, Afidemii—; *Ga*: Shwuoblo—; *Goa*: Cha de India—; *Gujerati*: Bala, Jangumethi—; *Hindi*: Bariara, Kareta, Kharenti, Paharibariara—; *Indo-China*: Bai choi, Vai choi—; *Kolami*: Ipirpion—; *Krepi*: Didinglome—; *La Reunion*: Grosse herbe dure, Herbe à balais—; *Malay*: Kelulut putih, Ketumbar hutan, Poko lidah ular, Sada turi, Telor belangkas—; *Malayalam*: Malatanni, Shruparuva—; *Marathi*: Chikana, Pata, Tukau, Tupkaria—; *Mauritius*: Herbe panier, Herbe à panier à fleurs roses, Mauve du pays—; *Mende*: Helui—; *Mundari*: Ipirpichig, Marci-baeat, Marcijono—; *New Hebrides*: Herbe à balais—; *Pampangan*: Higothalato, Pamalis—; *Porebunder*: Bala, Dungauba—; *Sanskrit*: Bala, Brihannagabala, Pata, Pila, Pitberela, Rajbala—; *Santal*: Bir miru baha—; *Susu*: Fankumaduma—; *Tagalog*: Escobaghaba, Higothalato, Pamalis—; *Tamil*: Arivalmanai-pundu, Arivalmukkan, Kayappundu, Malaidangi, Malaikkurundali, Mayirmanikkam, Ponimusuttai, Vattatiruppi—; *Tanna*: Teranmatin—; *Telugu*: Chittimu, Gayapaku, Muttavapulagamu, Nelabenda, Sahadevi, Visaboddi—; *Timne*: Ekboentomoer, Ka-tanta, Koe-tanta, Makboentomoer—; *Tupin*: Tupitcha—; *Twi*: Apono, Obranetuata, Petekuku, Siwabiri, Sowa—; *Uriya*: Ancharna, Siobola, Sunakhodika—; *Visayan*: Higothalato, Pamalis, Silhigon—; *Yoruba*: Oshepotu, Oshepotufunfua—.

2. *Sida cordifolia* Linn. occurs in the tropical and subtropical regions of both hemispheres. It is generally distributed in moist places.

A decoction of the root with ginger is given by Hindu physicians, in intermittent fever. It is also administered in fever accompanied by shivering fits and strong heat of body. The powder of the root-bark is given with milk and sugar for the relief of frequent micturition and leucorrhoea. In diseases of the nervous system the root is used alone, or in combination with other medicines.

The bark of the root with sesamum oil and milk is very efficacious in curing cases of facial paralysis and sciatica when caused by the inflammation of the nerves concerned (Koman).

In Cambodia the root is considered diuretic and depurative; it is given in the treatment of gonorrhoea and ringworm.

The Thongas of Portuguese East Africa use the plant as a children's medicine.

The leaves, mixed with rice, are given to alleviate the bloody flux.

In the Konkan, the leaves, with other cooling leaves are applied in ophthalmia; the root-juice is used to promote the healing of wounds, and the juice of the whole plant pounded with a little water is given in $\frac{1}{4}$ seer doses for spermatorrhoea.

The seeds are reckoned aphrodisiac, and are administered in gonorrhoea. They are also given for colic and tenesmus.

Bengal: Bala, Barila, Brela, Svetberela—; *Cambodia*: Kantrang bai sa—; *Canarese*: Chittuharalu, Hettutti—; *Ewe*: Didinglome—; *Fanti*: Kumpa—; *Gujerati*: Baladana, Khareti—; *Hausa*: Farar hankufa, Farin garmani, Garmani, K'ardafi, Mai-k'alo—; *Hindi*: Barial, Bariala, Bariar, Kharenti, Khoroeti, Kungyi—; *Katagum*: Kardafi—; *Konkan*: Kobirsirbhaji, Muttava—; *La Re-*

union: Mauve—; *Malay*: Kelulut putih—; *Malayalam*: Katturam—; *Marathi*: Chikana, Khiranti—; *Mauritius*: Herbe dure, Herbe panier, Herbe à panier, Mauve à feuilles veloutées, Arivamouc, Barjala, Barriar—; *Mundari*: Huring-mindilata—; *Porebunder*: Bal, Bala, Baldana, Balnochotvo—; *Punjab*: Kharenti—; *Sanskrit*: Badiyalaka, Bala, Baladhya, Balini, Bhadra, Bhadrabala, Bhadrodani, Brela, Jayanti, Kalyanini, Kanaka, Kathorayashtika, Kharakakash-tika, Kharayashtika Krura, Motapati, Nilaya, Odanavha, Odani, Odanika, Phani-jivaka, Prahasa, Raktatandula, Samanga, Samansha, Shitapaki, Suvarna, Svetbe-rela, Variga, Vataghni, Vatyalaka, Vatyali, Vatyapushpi, Vilala—; *Sind*: Bur-rayra—; *Sokoto*: Garamani, Faringaramani—; *Tamil*: Arivalmanaippundu, Nilatutti—; *Telugu*: Antisa, Chirubenda, Muttavapulagamu, Suvarnamu, Tellagorra, Tellantisa—; *Thonga*: Sitjhesinyana santlhaba—; *Timne*: Makboentomoer—; *Uriya*: Badiananla, Bisookopari—; *Yemen*: Ren—.

3. **Sida grewioides** Guill. and Perr. occurs in the North-West Provinces and Sind. It is distributed to Arabia and tropical Africa.

In Jodhpur and Jaisalmer the seeds, ground and mixed with goor, are used as a cure for lumbago.

Rajputana: Ball, Dabi—.

4. **Sida rhombifolia** Linn. is found as a weed of waste places, throughout the tropics of both hemispheres.

The root is held in great repute in the treatment of rheumatism.

The Mundas apply the pounded leaves on swellings.

In Lakhimpur (Assam) the roots are taken internally to help childbirth. The herb is also tied round the abdomen for the same purpose (Carter).

The stems abound in mucilage, and are employed as demulcents and emollients both for external and internal use.

In Europe the plant has been regarded as a valuable remedy in pulmonary tuberculosis and rheumatism. Conflicting reports of its efficacy as a tuberculosis remedy have been published.

In Madagascar the plant is mostly used as an emollient; an infusion of the root is given in dysentery; the leaves are pounded and applied to tumours, or chewed and applied to boils.

Sanskrit authors recommend the use of the plant in combination with other drugs for the treatment of snake-bite and scorpion-sting. But Caius and Mhaskar have shown experimentally that no part of the plant is an antidote to either snake or scorpion venom.

Afrikaans: Pretoria-bossie, Taaiman—; *Australia*: Common Sida Weed, Jelly Leaf, Native Lucerne, Queensland Hemp—; *Bambara*: Balan-balan—; *Bengal*: Lal berela, Pitabala, Pithala, Svetbarela—; *Benin*: Aramabi—; *Betsileo*: Kisin-dahorina—; *Canarese*: Bennegaragu, Gubethadegida, Kallangadale—; *Central America*: Escoba—; *Ceylon*: Atipalacheddu, Chittamadi—; *Cuba*: Malva de cochino—; *English*: Paddy's Lucerne, Queensland Hemp, Sida Hemp—; *Espiritu Santo*: Niveding irin irin—; *French*: Herbe à balais, Fausse guimauve, Guimauve des Indes—; *Fulani*: Gogil—; *Guam*: Escobilla—; *Gujerati*: Baladana—; *Hausa*: Faskara saiwo, Miyar tsanya, Namijim hankufa—; *Hawaii*: Ilima—; *Hindi*: Bariara, Bhiunli, Kharenti, Pitabala, Sahadebi, Sahadeva, Swetbarela—; *Hova*: Tsindahoro—; *Ibo*: Azu uzo mbo, Udo agheregha—; *Indo-China*: Choi duc, Ke dong tien, Ke hoa vang—; *Katsina*: Miyatsanya—; *Kolami*: Ipirpion—; *Korambo*: Sose, Susi—; *La Reunion*: Faux thé, Herbe dure—; *Malay*: Bunga padang, Poko lidah ar, Seliguri guri padang, Senda guri padang—; *Malayalam*: Anakkuruntotti, Totti, Valanguruntotti, Vatturam—; *Malinke*: Mali-sobo—; *Marathi*: Chikna, Sadedā, Sahadevi—; *Mauritius*: Herbe balais, Herbe à balais, Thé bâtarde, Kareti, Vattatirippi—; *Mundari*: Ipiripiung, Pipirpiung—; *Mende*: Helui—; *New South Wales*: Paddy Lucerne—; *Nimar*: Bariari—; *North America*: Canary-island Tea-plant, Jelly Leaf, Paddy's Lucerne, Queensland

Hemp, Sida Hemp, Tea Plant—; *Nyasaland*: Denji—; *Owerri*: Azu uzo mbo, Udo agheregho—; *Panama*: Escobilla—; *Pampangan*: Escobanghabo—; *Porebunder*: Betraubal, Betraubaldana—; *Samoa*: Mantofu—; *Sanskrit*: Ahikhanda, Atibala, Bala, Barela, Brihadagala, Devaarha, Devabala, Devasaha, Gandhavallari, Gandhavalli, Jyeshthabala, Karambhara, Kesarika, Keshawardhini, Keshruha, Lalbarila, Mahabala, Mahagalarthaprasadini, Mahagandha, Mriga, Mrigadini, Mrigarasa, Pitapushpa, Pitapushpi, Prasadini, Sahadeva, Sahadevi, Samanga, Sarini, Varshapushpa, Varshpushpi, Vataghni, Vatia, Vatyayani—, *Sema*: Thopfu-ga-bo—; *Sinaloa*: Malva colorada—; *Sinhalese*: Kotikanbevila—; *Sokoto*: Miyatsanya—; *South Africa*: Queensland Hemp—; *Tagalog*: Escobanghaba—; *Tahiti*: Burume—; *Tamil*: Anaikurundotti, Kurundetti, Tenacham—; *Telugu*: Atibala, Gubatada, Mayilumanikyamu, Muttavapulagamu—; *Tigrinia*: Deche-dabro—; *Tulu*: Kadiru—; *Uriya*: Dholabadeanla, Nalobadianla—; *Uruguay*: Afata, Malvavisco, Mata alfalfa, Tipicha—; *Venezuela*: Escoba—; *Visayan*: Basengbaseng, Escobanghaba—; *Wolf*: Ndetalmnor, Ndetinor—; *Yoruba*: Ewe ifin—; *Zulu*: iVavana—.

5. **Sida spinosa**, Linn. occurs throughout the hotter parts of India from the North-West to Ceylon. It is distributed over the tropical and subtropical regions of both hemispheres.

The leaves are demulcent and refrigerant, and are useful in cases of gonorrhoea, gleet and scalding urine. They are bruised in water, strained through cloth, and administered in the form of a draught.

The decoction of the root-bark and root is used as a demulcent in irritability of the bladder and in gonorrhoea.

The root acts as a gentle tonic and diaphoretic, and is employed in mild cases of debility and fever. They are useful also in the treatment of some forms of cattle disease.

Arabic: Kulbahebarri—; *Bengal*: Bonmethi, Gorakchaulia, Pilabarela—; *Canarese*: Kadumenthya—; *Deccan*: Janglimethi—; *Egypt*: Agul, Melukhiyet iblis—; *Gujerati*: Kantalobal—; *Hindi*: Bariar, Bariara, Gangeran, Gulsakari, Janglimethi, Khareti—; *La Reunion*: Herbe dure—; *Malayalam*: Kattaventiya, Mayirmanikkam—; *Marathi*: Gandedhaman, Gangeti, Kanteritukati—; *Mundari*: Mindilat, Mindilate—; *Persian*: Shambalidebarri, Shamlithedashti—; *Porebunder*: Balnansavenan, Kantalobal—; *Sanskrit*: Avishta, Bhadrandani, Chatupala, Devadanda, Gangeruki, Ghanta, Gorakshatandula, Hrisvagavedhuka, Jhasha, Kharagandha, Kharagandhini, Kharavallika, Kharyashthika, Mahagandha, Mahapatra, Mahaphala, Mahashakha, Mahodaya, Nagabala, Pila, Pitberela, Vishvadeva, Vishvadevi—; *Sinhalese*: Girivedi-bevila, Kotikambabila, Manmanikkam—; *Tamil*: Arivalmanaippundu, Mayirmanikkam—; *Telugu*: Chinnamuttamu, Chinnamuttavapulagmu, Mayilumanikyam, Muttavapulagamu, Ternallabenda, Tirinelabenda—; *Uruguay*: Malvavisco—.

6. **Sida veronicaefolia** Lam. is distributed throughout the hotter parts of India, and throughout the tropical and subtropical regions of the world.

The flowers and unripe fruit are given together with sugar for burning sensation in micturition.

Among the Santals the leaves are pounded and used as a local application to cuts and bruises. They are also given in the diarrhoea of pregnancy. In the Coimbatore District, they are ground up with cummin seeds, onions, and the succulent portion of aloe leaves, mixed with buffalo butter-milk, and given to cattle suffering from rinderpest.

Bengal: Junka—; *Ceylon*: Palampadu—; *Gujerat*: Bhoyabala—; *Hindi*: Bananiyar, Bhiunli, Kharenti—; *Kolami*: Bariar—; *Marathi*: Bhoybal, Bhui-

chikna—; *Mundari*: Jangkī, Mindilat, Mindilatanari—; *Sanskrit*: Bhumibala—; *Santal*: Bariar, Bir, Jokhasakan, Tandi—; *Sinhalese*: Bevila—; *Tamil*: Palampasi—; *Telugu*: Gayapuwaku, Nellabenda—.

THESPESIA.

The genus consists of 5 species inhabiting warm regions.

T. populnea Corr. is used medicinally in Indo-China, the Malay Archipelago, the Society Islands, Mauritius, Mozambique, and Upper Guinea; *T. campylosiphon* Rolf. is used in the Philippine Islands.

Thespesia populnea Soland. occurs in the coast forests of India and Burma. It is largely grown as a roadside tree in tropical regions.

In the Central Provinces, the root is taken as a tonic.

In the Konkan, the flowers are employed in the cure of itch; and the leaves are employed as a local application to inflamed and swollen joints.

The fruit yields a yellow, viscid juice, which forms a valuable local application in scabies and other cutaneous diseases. The affected parts of the body are daily washed with a decoction of the bark.

A decoction of the bark is given internally as an alternative.

The bark is astringent and is prescribed in the Philippines for the treatment of dysentery in the form of a decoction. The fruit, leaves, and root are applied externally in scabies and other skin affections.

In Tahiti, the fresh capsules, bruised and applied to the forehead are said to cure migraine; the yellow sap exuding from the peduncles is considered a cure for the bites of insects, especially of the centipede; it is also useful in sprains, bruises, and all cutaneous affections. In Mauritius, the bark is described as depurative, and used in dysentery, haemorrhoids; the juice of the fruits being applied to warts.

In Madagascar a decoction of the bark is commonly used in chronic dysentery and cutaneous diseases; the sap is applied externally for herpes.

Rumphius speaks highly of the value of the heartwood as a remedy for bilious attacks and colic, and in a kind of pleurodynia from which the Malays often suffer.

Waring tried the bark in scabies and other cutaneous diseases; in some cases, it exercised a favourable influence, but in the majority it was productive of little or no benefit.

The leaves are ground into a paste and applied externally in children's eczema; so also an oil prepared by boiling the ground bark in coconut oil is applied externally in psoriasis and scabies. The contents of the fruit which is a capsule are applied externally to ringworm. A decoction of the bark is given internally in skin diseases. The ground leaves and contents of the capsule applied externally in eczema and ringworm respectively were found to be useful. A compound oil of the bark and capsule was given in cases of urethritis and gonorrhoea with beneficial results (Koman).

Ahanta: Tamsi—; *Bengal*: Dumbra, Gajashundi, Palaspipal, Parash, Pares, Pares, Parespipal, Porash Prash—; *Bombay*: Bhendi, Bhindi, Palaspiplo, Parsipu—; *Bougainville Straits*: Kaikaia—; *Canarese*: Arasi, Asha, Bangali, Bugari, Gandarali, Hurvashi, Huvarasi, Jogiyarale, Kandasola—; *Central Provinces*: Ranbhendi—; *Ceylon*: Karavachu, Suriyagas—; *Cuba*: Majagua de Florida—; *Deccan*: Paraspippal, Paris—; *English*: Bhendi Tree, Portia Tree, Tulip Tree, Umbrella Tree—; *Eve*: Bobosenya—; *Fanti*: Adomba, Fref, Frefi—; *Fiji*: Mulo—; *French*: Porcher—; *Ga*: Adengkra, Fetsho, Fez, Foz—; *Gilbert Islands*: Bengibeng—; *Guam*: Kilulu, Quilulu—; *Gujerat*: Bendi, Bhindi, Parasapiplo—; *Hawaii*: Milo—; *Hindi*: Bhendi, Gajadanda, Gajhand, Parashajhad, Paraspipal, Parispipul, Parsipu, Pipal, Pippul, Porush—; *Honduras*: Cork Tree—; *Hova*: Valo—; *Indo-China*: Chrey sramol, Tra bo de, Tra bua, Tra lam vo—; *Konkani*: Benddy, Maner—; *La Reunion*: Porcher—; *Malay*: Baru, Buah keras laut—; *Malayalam*: Chandamaram, Chilanti, Kallal, Pupparrutti, Puvarasu, Puvvarasha—; *Marathi*: Bendi, Bhenda, Bhendi, Paraspipar, Parsachajjhada, Ranbheudi—; *Mauritius*: Porché, Porcher, Valou, Poursong have marom, Paraspipal—; *New Caledonia*: Bois de rose, Daleni, Kabaoui—; *Nzima*: Eijan, Tamsi—; *Ponape*: Pana, Pena, Pona—; *Porebunder*: Paraspiplo—; *Porto Rico*: Palo de jagueca—; *Portuguese*: Pau rosa, Pau de rosa—; *Punjab*: Paharipipal, Paraspipal—; *Rarotonga*: Miro—; *Sakalave*: Valomena—; *Samoa*: Milo—; *Sanskrit*: Gardabhanda, Kamandalu, Kandarala, Kapichuta, Kapitana, Kuberaksha, Kundah, Nandi, Parisha, Phalisha, Suparshvaka—; *Sefwi*: Eijan—; *Sinhalese*: Gansurigaha, Suriya, Suriyagaha—; *Sunderbunds*: Dumbra, Paras, Paraspipal—; *Tagalog*: Baboigubat, Babuy, Banalo, Boboigubat, Bubuygubat, Malasantol, Malibago—; *Tahiti*: Milo—; *Tamil*: Kallal, Piram, Pupparrutti, Puvarasu—; *Telugu*: Gangaravi, Gangareni, Munigangaravi—; *Tonga*: Milo—; *Tulu*: Jogi, Jogiyattasa—; *Twi*: Ayedru, Benorsenye—; *Uriya*: Gunjausto, Habali, Porosoppoli—; *Visayan*: Bulacan—; *Yap*: Bonabeng—.

URENA.

The genus consists of 3 species inhabiting the warmer regions of both hemispheres.

The root is considered cooling and is used as a resolvent; the leaves are emollient; the flowers mucilaginous and bechic.

The following are used medicinally in the Philippine Islands and Indo-China—*U. sinuata* Linn.—; in South America—*U. lobata* Linn., *U. sinuata* Linn.—; in West Africa and La Reunion—*U. lobata* Linn.—.

A. Carpels armed with bristles.

I. Leaves not divided below the middle *U. lobata*.

II. Leaves divided below the middle *U. sinuata*.

B. Carpels smooth, unarmed *U. repanda*.

1. *Urena lobata* Linn. is a weed of waste places, forest-clearings and roadsides, occurring in all tropical countries. It is very common in the bamboo and mango clumps of Bengal.

The root is a very popular diuretic in Lakhimpur. In Chota Nagpur it is employed as an external remedy for rheumatism.

In West Africa the plant is used medicinally as a mucilage.

In La Reunion and Mauritius the leaves and roots are made into poultices and used as an emollient; the flowers are considered pectoral.

In Guiana an infusion of the flowers is used as a gargle for aphthae and sore throat.

A decoction of the root and stem is used in Brazil as a remedy in windy colic; the flowers as an expectorant in dry and inveterate coughs.

Akim: Sowa—; *Akwapim*: Petekuku—; *Bakwiri*: Sofo—; *Bambara*: So-so—; *Basari*: Mangemboleba, Tingmile—; *Bengal*: Benochra—; *Benin*: Oronhon—; *Betsileo*: Paka, Pampaho, Pampana, Pampano—; *Brazil*: Aramina, Carrapicho, Guaxima, Malvaisco, Malvisco, Uaixyma—; *Burma*: Katsaenai, Whetkhyapanai—; *Canarese*: Otte—; *Dehra Dun*: Unga—; *Espiritu Santo*: Neapsara—; *Fanti*: Akyeng, Finina—; *Florida*: Caesar Weed—; *Ga*: Asofotoro—; *Gambia*: Bubobubo, Toja—; *Hausa*: Bak'in garmani, Igiyar rafi, Jan tsu, Ka-fi-rama, Ramaniya, Ramarama, Ramo-ramo, Uwarmaganni—; *Hindi*: Bachata, Bachit, Bachita, Banokra, Brachta—; *Ibo*: Udo agheregha, Udo azuro—; *Kabure*: Kaluka—; *Katsina*: Ramaniya—; *Konkan*: Villiah—; *Koranko*: Sose, Susi—; *Lagos*: Toja—; *La Reunion*: Hérison rouge—; *Losso*: Mitti, Mondondo, Tangmuid—; *Malay*: Pepulut, Perpulut, Poko kelulut, Pulut-pulut—; *Malayalam*: Udiram, Uram, Uran, Vatto—; *Malinke*: Susu—; *Mandingo*: Bubo bubo, Da ba julo, Da julo—; *Mano*: Gbo su—; *Marathi*: Rantupkada, Rantupkuda—; *Mauritius*: Herbe panier, Herbe panier à feuilles incisées—; *Mende*: Sogbei, Subwe, Tsobwe, Tsogbei—; *Mundari*: Mindilat, Mindilata—; *North Western Provinces*: Bachita—; *Neima*: Meteku—; *Porebunder*: Wagdaubhindi—; *Sakalave*: Kirijy, Kiriza, Kisilenjo, Tsikilenza—; *Sanskrit*: Vanabhenda—; *Santal*: Bhidijanetet—; *Sierra Leone*: Horse Whip—; *Sinhalese*: Patta apele, Pattu epala, Valta epala—; *Sokoto*: Ramaniya—; *Susu*: Nore, Nure—; *Tamil*: Ottatti, Ottuttutti—; *Telugu*: Peddabenda—; *Timne*: Dafen, Defenfen, Ekboentomoer, Ka-fenzen, Ma-denfen, Nafenfen—; *Tivi*: Ishoho—; *Tschaudio*: Kadjangbea—; *Tupin*: Guaxima—; *Twi*: Petekuku—; *Umu Ahia*: Udo agheregha, Udo azuzo—; *Uriya*: Bilokopasia, Jotyaholo—; *Wassaw*: Nsa-ne-nsa—; *Wolof*: Padat, Paddet, Pundere—; *Yoruba*: Ake-iri, Akeri, Ake-riri, Bolo-bolo, Ilasaagbonrin, Ilasa-omode, Ilasa-oyibo—.

2. **Urena repanda** Roxb. is found in the Punjab, Dehra Dun, the Central Provinces, the Northern Circars, the sal forests of Ganjam, and Ava.

The root and bark are believed by the Santals to be a cure for hydrophobia.

Santal: Sikuar—; *Uriya*: Jotofotia, Sikhini—.

3. **Urena sinuata** Linn. is found throughout the hotter parts of India. It is distributed over the tropics of both hemispheres.

In Chota Nagpur the root is used as an external application for lumbago.

In the Philippines the root is considered emollient, refrigerant, and maturant; the leaves are prescribed in inflammation of the intestines and the bladder.

The plant is considered emollient in Brazil and a decoction is given in colic; an infusion of the flowers is used in bronchitis.

Bengal: Kunjia—; *Bombay*: Tapgote—; *Brazil*: Carapicho, Carapicu, Uru-curano—; *Chota Nagpur*: Berilat—; *Fulani*: Uwarbaganeji—; *Guam*: Dadangsi, Dadanse—; *Hausa*: Ramaniya, Uwar maganni—; *Hindi*: Kunguya, Kunjuya, Lotloti—; *Indo-China*: Bay, Ke dau nguo, Phu thien hoa, Vai—; *Japan*: Bondenkiva—; *Malayalam*: Uram—; *Marathi*: Lichi, Ramkapasi—; *Matheran*: Lichi, Rankapshi—; *Mundari*: Mindilat, Mindilata—; *Nupe*: Rama—; *Pam-pangan*: Colotan, Colotcolotan, Dalupan, Molopolo—; *Philippines*: Culutan—; *Porebunder*: Wagdaubhindo—; *Porto Rico*: Cadillo pata-de-perro—; *Samoa*: Mautofa—; *Santal*: Mothabedijanetet—; *Sinhalese*: Hinappele, Hinepala—; *Tagalog*: Colotan, Colotcolotan, Dalupan, Dalupang, Molopolo—; *Tamil*: Ottatti, Ottuttutti—; *Telugu*: Nallabenda, Padanikada, Piliyamankena—; *Visayan*: Colotan, Colotcolotan, Culuculutan, Dalupan, Dalupang, Molopolo—.

OBITUARY

RAJA SIR DURJANSALSINGH, K.C.I.E.

The popular and progressive Ruler of Khilchipur State, Rajah Sir Durjansalsingh, K.C.I.E., passed away on the night of 8th September 1942 at the age of 46 years. His sad and premature demise is widely mourned even outside his State. He was born on 26th August 1897, and assumed his powers as Ruler on 23rd February 1918. During his regime of 24½ years he introduced many social and legislative reforms in the State. He was a Ruler with a very broad outlook and progressive views and was always anxious for the wellbeing of his people. He was for many years a life member of the Society and took an active interest in its work.

REVIEW

I.—CUCKOO PROBLEMS by E. C. Stuart Baker, M.B.O.U., H.F.A.O.U., etc., with 8 coloured and 4 monochrome plates, xvi+207 pp. H.F. & G. Witherby Ltd., London (1942). Price 25/ nett.

Here at last we have the book that Mr. Stuart Baker promised us in his Appeal published in this Journal a few years ago for information concerning parasitic cuckoos. Bird lovers in general, and students of breeding parasitism and cuckoo-lore in particular, will welcome its advent.

Mr. Stuart Baker's fame as an oologist is great and his interest in cuckoo problems well known. His experience and opportunities have been vaster than vouchsafed to most, extending as they do to some 70 years of diligent field work, the greater part of it in a province of India where parasitic cuckoos are exceptionally abundant. This knowledge has been supplemented by cuckoo studies in England and many parts of Europe as well. He was assisted in his work in Assam by a number of local collectors trained by himself and by the veteran Alan Hume, and in whose observations and reports he sees reason to place the greatest confidence.

It is doubtful if at the present time there is another ornithologist better qualified than Mr. Baker to give us more authentic factual data of the many cuckoo problems that confront the enquirer. His dicta are based chiefly upon his own magnificent collection of some 6000 parasitic cuckoo eggs from all parts of the world, the largest proportion of which have been either collected by himself or by collectors on whose data he can place complete reliance. Others have been obtained in exchange from collectors of repute. All this puts the brand of authority upon his findings and conclusions which are therefore deserving of the greatest respect. Obviously there are a great many points still remaining to be cleared up, but this book certainly represents a definite milestone in our journey towards the goal.

A general idea of the wealth of material contained in the book can be gained from some of the subjects dealt with. They are: Elimination of unlike eggs by desertion or ejection, Experiments showing that birds can discriminate between like and unlike eggs, Adaptation in colour and size of eggs of Indian and European cuckoos, How adaptation has been attained, The various methods by which the cuckoo lays its egg in the nest of the fosterer, How cuckoos' eggs can be distinguished from like eggs of fosterers, Territories occupied by cuckoos for laying, How many eggs a single cuckoo lays, and so on.

The book ends with 7 Appendices covering no less than 26 closely printed pages and giving details of eggs of cuckoos of various species and subspecies in the author's collection or to which he has had access, the various fosterers in whose nests they were taken, the comparative weights and measurements of the two, and other useful data—all of which confirms the reader's impression of the careful and painstaking work involved in its preparation, to say nothing of the life-time spent in collecting, sorting out and sifting the material.

The author has first of all attempted to show why it was necessary for cuckoo eggs to resemble those of its fosterers, and how this resemblance has been brought about and perfected by environmental selection. He proves that birds can discriminate between their own egg and another in their nest which is strikingly different in size and/or colouring. They either desert the nest on discovery of an intruder or eject the strange egg. Naturally therefore, the greater the resemblance of a cuckoo's egg to that of its fosterer, the greater the chance of its being adopted and hatched. This sort of selection working through countless generations of the cuckoo has evolved an egg which in some cases is so like the fosterer's in every way that it can often be distinguished from it only by weightment. This, he tells us, is on the whole the only reliable method of differentiating between the two eggs. The cuckoo egg is consistently heavier—in some cases considerably so—than that of its normal fosterer, irrespective of the species or subspecies of cuckoo.

Even among cuckoos of the same species or subspecies, and frequently in a circumscribed locality, there are different strains or *gens*. For example one may be, say, a Pipit-Cuckoo which habitually lays in nests of pipits; another

a Pied Wagtail-Cuckoo in the same way, and so on. The inference is—indeed it has been ascertained, and may now be taken as generally proven—that cuckoos hatched in pipits' nests return for laying, generation after generation, to pipits' nests only, and in the course of this their eggs develop greater and greater resemblance to those of the fosterer.

The methods by which a cuckoo lays its egg in a fosterer's nest are fully discussed. It is suggested, admittedly on slight (but none the less convincing) circumstantial evidence that in addition to the two accepted methods viz. laying direct into an open nest, and projecting the egg into nests in inaccessible holes or under stones (such as a stonechat's) there is the third method which has been alternately affirmed and denied in the past. That method is the depositing by the cuckoo with its bill of an egg it has laid elsewhere, into a nest wherein deposition by the other two methods is completely impossible, due either to the situation or the construction of the nest. Further field observation in the light of the evidence adduced by the author will no doubt help to end the controversy. He himself considers it highly probable that this method is frequently employed since there seems no other alternative possible.

The eggs laid by one individual cuckoo are all so alike that it is evidently possible to place them as such with certainty. Making use of this fact, and by examining the ovaries of laying birds, added to the knowledge that the larger cuckoos lay at intervals of 48 hours, i.e. every alternate day (some of the smaller species lay at 24 hour periods), it has been possible to ascertain with some accuracy that a single female of the genus *Cuculus* lays from 14 to 20 eggs in a season.

Among the author's conclusions which remain to be fully proved are that the colouration and character of the cuckoo's egg are inherited from mother to daughter, and that the male cuckoo cannot influence these. As is well known, the female cuckoo is polyandrous (or rather, promiscuous) in her habits. It was suggested by Chance in his 'Cuckoo's Secret' and is now confirmed by the present author, that the female cuckoo selects a territory for her layings and protects it against all comers. But Mr. Stuart Baker is able to show that 2 or more cuckoos of different *gens* (parasitic on different fosters) have no objection to sharing the same area of ground. Mr. Baker believes that facts are against the theory that the male cuckoo in any way, by heredity or otherwise, affects the colour of the egg. But if it be accepted that one *gens* of female cuckoo can rigidly cuckold a given fosterer generation after generation, we can see no insuperable obstacle against allowing that only that particular *gens* of male cuckoo mates with the same *gens* of female cuckoo (albeit promiscuously) and that some degree of influence may thus be exerted by him through heredity upon the colour and character of the egg produced by his progeny. It seems to us that this is a problem whose solution can only be found by a well-planned system of marking cuckoos with coloured rings which would enable the recognition of individual birds in the field.

Many other matters of interest concerning the breeding biology of parasitic cuckoos are dealt with. This is perhaps the most complete, up-to-date and thorough-going work on the subject and the appendices are invaluable for reference. Its simple and non-technical style will appeal to the general reader, while the 8 coloured plates of cuckoo and fosterer eggs help to illustrate many of the truths in a graphic way.

But, the thing which every serious reader and worker will miss is an index. The omission is indeed unfortunate, as it must make ready reference to the wealth of material the book contains, a tedious business.

The author is to be congratulated upon sharing with the public the results of his long experience and study of this fascinating subject in such a useful and pleasant form.

S. A

AN APPEAL.
CUCKOO PROBLEMS.

Ex. *Field*, May 30, 1942.

SIR,—There are many problems connected with the life history of the cuckoo which can only be solved by dissection of the female cuckoo. May I appeal through your columns for help in this matter, by asking those who can obtain breeding specimens of the female cuckoo to be so kind as to send them to the following address: D. S. Ellis, Esq., University College, Oxford.

He has very kindly undertaken to carry out the dissections, make the slides and give me notes on the results of his examination.

Among the questions which dissection may assist in proving are enumerated here:

(1) How many eggs does a cuckoo lay, at what intervals, and is there a definite break in the laying?

(2) Has the female cuckoo any muscular provision enabling her to project eggs into concealed or domed nests?

(3) Does the gullet and gape of the cuckoo differ constructionally from that of other Pico-Passerine birds?

(4) How is the colour deposited on cuckoo eggs, prior to their being laid?

(5) What are the chemical pigments so produced?

(6) What sources are they derived from?

Some of these questions have been answered in part already by Schönwetter, Rey, Chance, Makatsch and others, but scientific confirmation is still needed, as I have found out when writing my book on *Cuckoo Problems*. I have far too often had to write 'I believe' instead of 'We know.'

The easiest way to send the birds to Mr. Ellis would be to pack them in a small wooden box (to prevent crushing) having cut open the abdomen and inserted a wad of cotton wool steeped in formalin (one part formalin to 10 parts of water).

Female cuckoos do not call *cuckoo* but the bubbling note uttered by this sex is now generally known.

I shall be most grateful for any help given.

6, Harold Road,
Upper Norwood, S.E.19.

Yours faithfully,
E. C. STUART BAKER.

MISCELLANEOUS NOTES

I.—ADAPTIVE COLOURATION OF DESERT ANIMALS

From Mr. Burdon's note on page 250 of the August issue of the *Journal*, I gather that we are both agreed on the main points, though he maintains that desert colouration is wholly protective by itself and that immobility is not essential for it to be effective. He objects to any other explanation of the pale sandy colouration of desert animals except by the time-honoured, one and only panacea—Natural Selection.

The peculiar type of pale colouration commonly seen in deserts is so constant wherever deserts occur, in every part of the world, and applies to such divers animals and of so many different Orders—ranging from mammals to insects, diurnal as well as nocturnal, and including both hunters and hunted—that it seems impossible to believe that, in the first instance, it is not some outside physical factor that brings it about. It seems impossible, for instance, to believe that the pale colouration of such desert animals as bats and falcons, whose habits and biological associations are well known, can have developed solely through a stringent weeding out of unsuitable colour variants. But no field naturalist will deny that a desert-coloured animal is less visible in its sandy environment than one which is, say, bright scarlet; or that a scarlet-coloured animal scampering across the distant desert sand would be more conspicuous than a desert-coloured one. What I maintain is that to give complete protection to an animal from its natural or accustomed predators, the pale colour alone will not suffice. That animal will, in addition, have to remain perfectly immobile if it is to stand any chance of escape. On the whole it stands a greater likelihood of escaping from *chance* predators than from those who hunt it regularly.

We must remember that the desert predator is born and bred to desert conditions. Its eyes and senses are trained from infancy in what to look for, and this being so even immobility will not *always* save its desert-coloured quarry at close quarters. At a distance, however, sandy colouring plus immobility may help to protect it. But I submit that what the desert predator actually seeks, as it quarters the ground in search of prey, is not for every suspicious looking stone or mound in the hope that upon prodding it it may turn out to be its prey only shamming, but for any slight movement in the near distance that may catch a corner of its eye. In other words when the predator hunts it does not go about 'turning over every stone', so to say. But it is of the utmost importance that any movement to be taken notice of by the predator must be within a reasonable distance, i.e., a distance at which prey normally becomes interesting to its predator, and at which the latter stands a reasonable chance of circumventing the quarry either by cunning or by speed. I submit that prey at long range is of no practical interest to a

predator, such as it might perhaps be to a man with a high velocity rifle and telescopic sight. As prey is normally sought only at such 'reasonable' distance, it matters little to the predator whether at long range its prey is conspicuously coloured and visible, or obliterated against its background by virtue of its 'protective' colouration. To take Mr. Burdon's own example of the dog chasing the white arctic hare on snow. It is the visibility of the hare to the dog that really counts, and not to the distant onlooker of the chase. Mr. Burdon admits that at close range even its concealing colouration cannot hide him. As long as the hare remains visible to the dog, the dog will be interested in it. But as soon as the hare becomes invisible—which may be on account of 'its getting well ahead' or even by the intervention of some physical obstacle such as a bush, the dog will either lose interest and give up the chase, or he will rely on his sense of smell rather than vision in running the hare down.

It would be foolish to deny that desert colouration does sometimes protect, and it was never my intention to do so. What I still maintain, however, is that it is inconceivable that Natural Selection alone can be entirely, or even largely, responsible for the general sandy or so-called 'protective' colouration of desert animals. I feel that the rôle of Natural Selection in producing such colouration has been greatly exaggerated.

Mr. Burdon, I take it, accepts the general axiom that animals living in deserts are pale coloured, and their counterparts living in humid forest areas are dark. Presumably he also maintains that the darkening of animals living in the humid areas is protective, and Natural Selection alone is responsible for producing it. He will find this attitude much more difficult to defend than in the case of desert colouration, perhaps. In some instances the darkening is so slight that it requires a series of specimens for comparison to show its presence. How this insignificant darkening could be of protective value to its possessor is difficult to understand. Would Mr. Burdon ascribe the pale colouration of the desert sand itself, in deserts the world over, also to Natural Selection? If not, what is the factor or set of factors he holds accountable for its being consistently pale sandy? If he is prepared to admit that in the first instance it is not Natural Selection but some purely physical factors (of which, as Meinertzhagen suggests, the excess of ultra-violet radiation may be one), why does he find it so difficult to concede that this same physical factor or factors may as well be responsible for the pale colouration of the animals that inhabit this sandy desert environment? The possibility that Natural Selection may in some cases perfect the original adaptiveness by eliminating orthogenetic colour mutants which are markedly unsuited to the environment, and by perfecting others, is not denied. Indeed, the dark colouration of the rodents Mr. Burdon mentions as living on black lava beds may quite understandably be explained by this theory. Many other cases of his sort are known, especially among ground frequenting birds such as larks and partridges, where dark coloured races are found living on isolated and restricted 'oasis' of dark soil, while in the surrounding sandy desert pale, apathetically coloured forms exist.

But it must be remembered that the question of the exact relation of soil colour to the colouration of the animals living upon it, and of the interaction of physical factors producing the similarity or 'adaptiveness', is as yet very imperfectly understood. It seems rash in the present state of our knowledge to ignore other possibilities, and claim that Natural Selection alone and no other explanation can be offered for this circumstance. To do so would be to shut one's eyes to the various other plausible explanations put forward for this phenomenon.

As regards the seasonal change of colour in certain arctic animals, I am not in a position to discuss the question from personal knowledge. But I am prepared to concede the possibility (though I am not sure) that Natural Selection *may* play a more important part in the arctic than elsewhere, and that the change from brown in summer to white in winter may have been brought about in some measure by the elimination of such individuals as did not acquire a sufficiently protective colouration at the appropriate season. This does not exclude the possibility, however, of some purely physical factors being at work which conduce to the changing of the fur and feathers from one colour to another. For instance, one very important reason for white colouration in the arctic winter, in mammals as well as birds, may be that the low temperature (or another factor connected with the season) may exert some influence on the chemical economy of the body and suppress the superficial pigment while at the same time increasing the formation of gas vacuoles to which, as is well known, the quality of whiteness is mostly due.

I find no difficulty in allowing that one animal may be less susceptible to the influence of the directing physical action than another. This is seen in the fact that some animals of the arctic tundra change colour, while others living under identical conditions seem to fare no worse for not doing so. White colour may help a predator to hunt on snow as it may help the prey to escape, just as the normal dark colour may help them in the same way in summer. But the significance of the fact—also a very important one—that white fur or plumage helps to conserve more body heat for the possessor than any other colour, must not be lost sight of when considering any other theory. Protection against the elements may be just as cogent a reason for white colour as protection from foes. Indeed, considering its wholesale incidence, it may well be that the former is the more important reason.

Unfortunately, the book mentioned by Mr. Burdon, *Adaptive Colouration in Animals*, is not available, and I am therefore unable to assess the strength of the arguments by which he sets so much store. In any case I should consider 'misleading' a strong word to use in connection with my remarks in the Bahawalpur bird paper. I wish it were possible to be as cocksure about the correctness of one's views on such admittedly controversial questions as Mr. Burdon seems to be.

II.—THE COLOURATION OF THE NEWLY-BORN YOUNG OF THE CAPPED LANGUR [*TRACHYPITHECUS PILEATUS* (Blyth)].

Mr. R. I. Pocock¹ based his division of the langurs of the old genus *Pithecus* mainly on the colouration of the newly-born young. In his paper he described the young of *T. pileatus* at birth (newly-born) as 'a uniform golden or orange all over'. In my paper² *Observations on some of the Indian Langurs*, I disagreed with Mr. Pocock's statement and described the newly-born young of this langur as 'creamy white all over the body, with a slight ferruginous tinge along a narrow portion of the back and tail'. I also mentioned, that I did not notice any ferruginous tinge in the fresh specimen. In order to give some idea of the age of my specimen I mentioned that 'only two upper and two lower incisors had barely cut through the gums'. The only sure method to prove the point would be in captivity. Mr. Pocock evidently had this opportunity as evidenced by the fine photograph published with his article, of a langur which was born in the London Zoo.

However, in spite of this opportunity, Mr. Pocock overlooked what is perhaps another important detail in the newly-born young in this species, namely, the colour of the face, hand and feet. This point I referred to in my paper: 'Though the adult and yearlings have the face, ears, the palms of the hands and the soles of the feet *black*, these regions in the newly-born are pinkish flesh *not black*.' I was particularly struck by this characteristic on account of the fact that in the *entellus* group of langurs the face, etc. of the newly-born young are brownish or blackish.

Subsequent to the publication of the two papers referred to here, Mr. Pocock published the revised edition of the *Mammalia* of India (1939). On page 121 of this work I find the following paragraph:—

'I have seen skins of newly-born young of several different kinds of *Trachypithecus*, ranging from Assam to Java, all of the colour stated. The only exception to the rule apparently was supplied by an example of *T. pileatus*, recorded by McCann as white. But the young of this species known to me are typically golden.'

My specimens were obtained in 1930; my notes were published in 1934 and the new fauna appeared early in 1939. My *serial* material is in the collection of the Society. If Mr. Pocock doubted my statement, he could have called for the material and I have no doubt that the Society would have sent him the lot. He did not. If I was not perfectly sure of my facts, I would not have dared to contradict the authority of Mr. Pocock. To make doubly sure of my facts, I recently examined my specimen again. After eleven years of preservation my specimen is still creamy-white, but it is changing in tone as a result of age and the white is becoming discoloured. Nevertheless, I stick to my statement as I examined it when still in the flesh. Leaving this point aside, I see that Mr. Pocock has made no mention of the colouration of the face, etc. in

¹ *J.B.N.H.S.*, xxxii (1928) p. 660.

² *Ibid*, xxxvi (1934) p. 626.

the newly-born young of this species. This point has been completely ignored!

While on the subject of *S. pileatus* I would like to say that I am glad that it has been generically separated from the *entellus* group of langurs as it always struck me that there is a great difference between the two, when dealing with them in the field. The facial characters and expression of the two are very distinct. If we examine the skulls side by side it immediately becomes clear that *T. pileatus* has less of a muzzle and accordingly a flatter face than *Semnopithecus entellus*. The facial angle of the two is totally different. Apart from these differences there are other minor differences observable in the field.

BOMBAY NATURAL HISTORY SOCIETY,

C. McCANN.

BOMBAY,

August 4, 1941.

III.—ON THE MATING OF FLYING-FOXES (*PTEROPUS GIGANTEUS*).

On the third of March 1942 at 6 p.m. (Indian Standard Time) when passing near the Town Hall, Colombo, my attention was drawn to a colony of flying-foxes (*Pteropus giganteus*) which was being attacked by a number of house crows (*Corvus splendens protegatus*) that were returning to their roosts. At the time the sun was still bright and the trees on which the bats were hanging were scantily clothed with leaves, so every animal could be seen, easily hanging in its habitual pensile position, amongst the slender branches, some fifty feet from the ground. Several groups of two or three crows began to attack by pecking at the claws that held the flying-foxes suspended from the branches; they did not peck at either the body or the head. The bats, on being disturbed flew off and continued to circle round and round their roosting trees, while the crows carefully avoiding the powerful flying membranes of the bats flew above or below them and as they flew attacked their heads or their ventral surfaces. The former flying stronger than the crows, avoided them repeatedly and returned after a minute or two to new roosts, whereupon the crows followed and perched a few feet away. The bats now wide awake however quickly recognized the birds that were giving so much annoyance and moving towards them, boldly attacked in their turn, with deafening screams and drove the crows away by striking at them with their strong hooked claws.

There were four colonies within fifty yards and the crows were actively annoying the bats in all these colonies. The game, if game it was, continued for about half-an-hour; the crows then leaving and flying off in the direction of their own roosts. I have seen a similar attack by crows at 4-30 p.m. (Indian Standard Time) in Shertally, Travancore. In this place the annoyance was so great that the two colonies of bats flew right away in the bright sunlight. These colonies must have aggregated about three to four hundred bats.

At Colombo, the smaller colony of the four I have mentioned did not return to their roosts on 4th March, whereas the other three held their positions till early in April when my observations ceased owing to my departure from Colombo. In Colombo, the crows did not continue their annoyance after the third day.

It was while watching the attacks of crows that I noticed first the peculiar behaviour that was taking place between pairs of bats that were left undisturbed by the crows. In describing this peculiar behaviour I shall in the following paragraphs refer to the more aggressive or the active animal as male and the other the more passive as female. In the first instance, the male was observed to move nearer to the female as if to greet her but his advances were politely repulsed, there being no noise and undue fuss about the business. These first advances having been met almost with displeasure, the subsequent ones were received in a more friendly manner. The male continued to press his courtship and being repulsed a few more times was then readily accepted by the female and the two animals were seen in close embrace for a short time. Then the female separated and moved away first, the male following her from branch to branch till his advances were again accepted in a friendly manner and the pair was seen once more enveloped in their flying membranes for several short periods. Having come together on several occasions they now separated willingly, the female remained in her place only a few inches away from the male. Meetings and separations continued till about 7 p.m. and they separated for the last time and after about ten minutes the female flew off leaving the male behind. In another fifteen minutes, when it was quite dark, he also flew away. I counted about thirty pairs behaving in very similar fashion. The mating pairs were not the last to leave the colony as many individuals were seen remaining behind till it was completely dark. The meetings of the pairs were generally face to face though in the earlier stages they were seen one behind the other.

It was strange to see single bats remaining unconcerned when the pairs moved passed them; their attitude appeared to be 'I do not care what you do and I shall not interfere in your business—go on'—these individuals gave way when the amorous pairs passed and repassed them.

I had these bat colonies under observation for about three weeks and the same movements were seen throughout that period. The only trouble that arose was the increase in the size and the number of leaves on the tree after a few showers of rain and made accurate observations more difficult. Eventually the animals were so well shaded from the heat of the sun and concealed from observations from the ground that their movements could not be seen distinctly.

My observations made, at different times of the day, showed that pairing never takes place before 5-30 p.m. The only other movements I noticed were round about noon and late in the evening before the flying-foxes left their roosts. About noon much flapping of the flying membranes was seen. This was probably due to the intense heat of the day. The other movement noticed were late in the evening before they flew off. The flapping increased at this time and the arms were stretched as if to get ready for the evening

flight. Before it flew off each bat stretched its arms, flapped wings, suddenly raised its head and threw itself into the air, letting go its hold on the branch and flying off unconcerned after its companions. Every animal took its own course and never flew off in company with any of the others. The general direction of flight was usually the same but after a few yards the angles diverged and distances between them increased as they vanished in the evening gloom.

COLOMBO,

J. R. BHATT, B.SC.

July 2, 1942.

[For further accounts of the habits of the flying fox the reader should refer to 'Notes on the Flying Fox (*Pteropus giganteus*)' published in vol. xxxvii, p. 143 of the *Journal* and 'Further observations on the Flying Fox (*P. giganteus*) and the Fulvous Fruit-Bat (*Rousettus leschenaulti*)' vol. xlii, p. 587. Eds.]

IV.—TIGERS SWIMMING.

A tiger had killed a 'boda' (buffalo calf used as a 'kill') close to the bank of a river, some 50 yards wide, which flows into the Narbudda. When I arrived in the afternoon to sit up for the tiger, I found that the carcase of the 'boda' was floating in the centre of the river which in that place formed a large pool, with virtually no noticeable current. The 'machan' had been erected earlier in the day in a suitable tree overlooking the spot on the bank where the carcase was originally lying. It was presumably turtles which had dragged it into the water and some 40 yards down the middle of the pool out of sight from the 'machan'. I had no means of collecting the carcase from the pool which was deep and probably contained at least one mugger, and the 'Korku' with me preferred to trot back to camp and bring another live 'boda' than venture into the water. This 'boda' was tied up to the same stake to which the first had been tied, i.e., some 20 paces from the bank to where it had been later dragged and partly eaten.

At about 9 p.m. I heard the tiger approaching noisily over dead leaves, and expected it to attack the live 'boda' any minute. Instead, it walked down to the river bank, splashed into the water, swam out to the carcase and returned to the bank with it slightly lower down stream. Here, out of view from my 'machan', it made its meal again on the bank. The marks were later easily distinguishable in the mud and soft earth. The tiger left the carcase which still contained the stomach and intestines during the early hours of the morning, but when it got light the carcase was again in mid-stream. The live 'boda' was unmolested and I never got a shot.

On another occasion in February 1940 I had crossed the Subansiri R. at Dulangmukh in N. Lakhimpur in order to search for tiger and other pug marks in the jungle on the far side. On returning to the ferry at about 1 p.m. I noticed some tigress' pug-marks in the sand leading down to the river some 150 yards upstream from the ferry. These pugs had certainly not been there

when I had come over first at about 9-30 a.m. Some Miris were sitting waiting for the ferry and I asked them whether they had seen any tiger. They replied that about half an hour before one had come down to the waters' edge and swum over to a bare stoney island in mid-stream, walked across this and then swum over to the far bank and disappeared into the jungle. I verified their statement by crossing in the ferry and searching the bank for pug marks. I did not search for long as they were plainly to be seen wet on the smooth stones and in the mud between them.

The river at Dulangmukh in February is about 120 yards wide and the current flows at about 6 knots where the tigress crossed.

QUETTA,

R. K. M. BATTYE,

BALUCHISTAN,

Captain.

July 2, 1942.

V.—TIGER 'POOKING'.

There has been much controversy as to the exact significance of the curious call which a tiger makes at times, and which for want of a better name has been described as 'pooking'. The general consensus of opinion appears to be that it is a mating call, and the old idea that its intention is to locate a sambur by its answer and thus allow the animal to be stalked, has been to some extent discredited.

The latter view, however, is still held by the jungle tribes of the Nilgiri-Wynaad and finds striking corroboration in V. K. Arseniev's book *Dersu the Trapper*, in which it is stated that the Siberian tiger is in the habit of calling up 'wapiti' with the same intent. It is stated that the Siberian tiger's call has a slightly different note from the Wapiti stag's roar, just as the call of the Indian tiger differs in tone from the sambur's bell. So perhaps the old established idea may be correct after all.

My personal experience of this call is limited to a single instance. I was sitting up for a tiger over a live bait in the Mudumalai forest of the Nilgiri Wynaad some years ago and towards sunset heard what I at first thought to be a sambur call over half a mile away. My Kurrumba shikari, however, said it was a tiger, and listening carefully I did notice a slight variation in tone. The call was answered by a sambur feeding not far from the machan and the duet continued till I judged the tiger to be within 200 yards. Both animals then stopped calling and the sambur suddenly bolted past the machan—I neither saw nor heard anything more of the tiger but my Kurrumba was positive that it had been stalking the sambur.

BANGALORE,

E. G. PHYTHIAN-ADAMS,

August 21, 1942.

Major, I.A.

VI.—A COIN LODGED IN A TIGER'S PALATE.

Captain Chetwode's note under the above title published in volume xli, p. 167 of the *Journal* has brought forward a suggestion from Mr. MacDonald (*Journ. B.N.H.S.*, vol. xliii, p. 100) by way of explanation for this peculiar incident. I had the opportunity of examining the animal's skull shortly after it had been shot. Fortunately the skinner had preserved the soft portion of the palate and the coin. An examination of the bony palate and the flesh covering it showed that the pice had been lodged there for a considerable time. Slight bony growths at the spot and the cavity in the fleshy portion bore this out. The pice was intact and not perforated. It only bore slight marks, the result of friction.

There is no reason to suggest that the tiger was a man-eater, a point recognized by both Capt. Chetwode and Mr. MacDonald. Nor is there any foundation for the belief that the coin had been shot from a gun—it would have to be a large bore gun! Mr. MacDonald however suggests that the tiger may have obtained the coin from an animal having a necklace of coins in the heat of excitement when killing its prey. As pointed out already the coin had no perforation and thus could not have been used in a necklace, unless it had been stuck to a leather collar as is sometimes done.

To explain how the tiger got the coin, I must go back to how did the prey, whatever it was, get the coin? There appears to me to be two possibilities:—

(1) that the coin had been dropped by a villager and the prey picked it up by licking, and swallowed it—animals frequently lick metal for some unknown reason.

(2) that the coin had been tied up in a cloth, either by itself or along with others and that the cloth had been dropped. A hungry goat, cow or donkey found a 'wholesome' rag and swallowed it with its contents. In time the cloth was digested, and the coin or coins remained in the alimentary canal.

If the tiger's victim obtained the coin in either of these two ways, the passage of the coin from the victim to the tiger is quite an easy step. The tiger during its meal got the coin into its mouth and it accidentally lodged behind the soft palate. In this position it was separated from the floor of the mouth. Once in this cavity, any effort on the part of the tiger to dislodge it with its tongue only pushed the coin further forward, and in time the coin reached the spot where it was discovered—between the palatine bones and the tissue covering them. This appear to me to be the solution to this interesting accident.

VII.—BLACK PANTHERS.

As you will have gathered from another letter I am keenly interested in albinism in birds and animals; but to go to the other end of the scale I am interested in melanism too, although so far my experience has been confined to panthers only.

Black panthers are commonly considered to be freaks, specimens occurring in normal litters. But I have succeeded in breeding them 'true to type' and my experience has been that a pair of black panthers will always produce black cubs. My first female cub was obtained from the Straits Settlements, in which parts they are found more frequently than elsewhere. This cub, like others of its kind, had a vile temper and tried to scratch a couple of tigers in an adjoining cage, with the result that the tigers got annoyed and pulled the panther's shoulder right out of its socket through the bars. I put this cub ($\frac{3}{4}$ grown) out of its misery with a bullet.

I next got a female from Jamnagar and a full-grown pair (trapped wild) from Singapore and put the three together in a cage. The Singapore female was apparently barren; so I got rid of her. The others two bred as follows:—

(a) 1st litter, 2 cubs, male and female, both black. They came to a sad end when a few days old, as the mother refused to feed one and drowned the other in her drinking water through.

(b) 2nd litter, 2 cubs, male and female, both black. I still have them.

(c) 3rd litter, 2 cubs, both male, both black. The mother killed one by sitting on it and the other is still with me.

The mother and daughter (b) have both been put back to the sire (Singapore male) and are now in whelp.

The sire is jet black but the mother shows faint rosettes when in the sunlight. All adults are of good size and more 'thick set' in build than the normal panther. A peculiarity about them is that the fore legs are shorter than the hind legs, which makes them slope slightly towards the head, like Siamese cats (which small relative also originated from the regions noted for black panthers).

The cubs are born with a chocolate coloured milk coat with rather prominent rosettes; these latter gradually fade as the cubs grow older and the coat becomes blacker. I have noticed that cubs in succeeding litters appear to have rosettes more faintly marked than in previous litters.

The temper of both cubs and adults can only be described as vile. Panthers are notoriously 'uncertain'; but black panthers are real 'limbs of Satan': Normal panthers are comparatively docile. Gestation period is about 14-15 weeks. My records show mating 15-1-39, cubs born 16-5-39; Mating 2-3-40 cubs, born 20-6-40.

RAM SINGH BAHADUR,

K. C. S. I., F. Z. S.

PARTABGARH (SOUTH RAJPUTANA). *Maharawat of Partabgarh.*

August 19, 1942.

VIII.—A WINE-BIBBING PANTHER—AND OTHERS.

My state is 'stiff with panthers' and though I now seldom shoot them myself, finding the game rather monotonous after bagging 185 of them, they provide sport for some of my guests who are on shikar bent and keen on collecting a spotted coat or two. The bait consists of a goat tied on top of a platform raised about five feet off the ground to keep it out of reach of hyenas, and it is amazing how soon a panther learns where a free dinner is available.

One such panther took to killing regularly in daylight (early evening) and as the platform was conveniently situated my guests and I used to watch it from a 'hide' a few yards away. After a time I decided to provide it with free drinks as well as dinner and placed a stone trough near the platform and filled it with sweetened water. The Panther lapped a little liquid rather diffidently but later began to drink regularly and I mixed about 1/6th part of country (mhowa) liquor with the water. Again, to start with, the panther was rather suspicious of the new taste and smell but apparently got used to it and by degrees I increased the proportion of liquor to half and half.

By this time our friend looked forward to the cup that both cheered and inebriated, and became indeed a confirmed toper. He would invariably make first for the booze before tackling his dinner and frequently lay down after a drink and 'slept it off', forgetting to kill the goat that evening.

After some months he turned up with a mate; his female friend however was never seen to join him in a drink; she confined herself to killing and eating the goat. She was much more wary than her companion and disappeared at any suspicious sound or movement made by either us or him; in fact she seemed frightened of him and they never dined together.

This little '*tamasha*' went on for a long time, and after many goats had been taken, the male suddenly ceased to appear. I do not know what became of him. Perhaps he visited a distant bait and was shot. I certainly cannot imagine the dope fiend giving up his haunts and his habits for any ordinary reason. The female was trapped for my zoo. She was of normal size but had a tail only a foot long.

There was another panther that used to kill regularly by the light of a strong Petromax light suspended just over the bait, while we watched him from a short distance away. Panthers become very bold and daring, especially when they live close to human habitation, as many villagers, and their goats and dogs, know to their cost. When a panther takes to killing human beings, fortunately a rare occurrence, it is an infinitely greater scourge than a man-eating tiger.

Three of the largest panthers I have had were caught as cubs when 10 days old. A 6 ft. 6 in. female that was shot in a beat was found to be in milk; so a search was made and the cubs, 1 male and 2 females, were found. When these grew up they escaped

from my zoo and had to be shot. They measured 7 ft. 11 in. (male) and 6 ft. 7 in., respectively.

RAM SINGH BAHADUR,

K.C.S.I., F.Z.S.

PARTABGARH (SOUTH RAJPUTANA). *Maharawat of Partabgarh.*

August 19, 1942.

IX.—NOTE ON THE BREEDING OF THE MALABAR
GIANT SQUIRREL (*RATUFA INDICA MAXIMA*)
IN CAPTIVITY.

I have previously (1939) reported upon the birth of *Ratufa macroura* in captivity, but there seems to be no record of the breeding of the allied more imposing mainland species *R. indica*. In January 1942 I received in exchange from the Trivandrum Zoological Gardens an adult pair of *R. indica maxima*. Both animals had been some time in captivity in Trivandrum, the male since 4th July 1939 and the female since 2nd July 1940, before being sent to me. Prior to this they had been kept as pets by private individuals. They had not previously bred, nor had there been any record of the breeding of this form in the Trivandrum Gardens hitherto.

The animals were immediately released into a large open cage 6 ft.×6 ft.×6 ft. with a two-roomed sleeping compartment at the back, similar to the one in which I had previously succeeded in breeding *R. macroura*. No unusual behaviour was noted until 24th April 1942, a little over four months after their release into this cage, when the female was observed to spend most of the day in her sleeping box, not even coming out to feed. The same occurred on the following day, when naturally I felt something was amiss, when I discovered that she appeared to be straining severely and I concluded that she was possibly in labour. This proved to be the case, for the next day, when she came out for a meal, I observed a single naked baby inside the box. (The male was removed at this stage). No pattern was discernable in the baby's skin, but in two day's time it was noticed to be blacker in the anterior half than posteriorly. By the following day the dark colour had spread all over the body, and it could be seen to be due to a fine, close-fitting coat of silky hairs,—approximately at the same age as it was found in *R. macroura*. Its eyes were not yet open. These did not open until some time in the last week of May, when the animal was about five weeks old, which seems considerably delayed compared with the condition observed in *R. macroura*, whose baby was able to run about at the age of one month. On 3rd June it first peeped out of its nest box; and the following day it came out altogether for the first time.

The peculiar patterning of the coat in *R. indica maxima* appeared early. Although on the fourth day the whole body, except the ventral surface appeared uniformly dark, within a very few days,

when the hairs had had time to erupt sufficiently, it could be observed that the ears, nape, and the back and sides of the body were deep maroon, duller than in the adults; whilst the posterior part of the back, rump, tail and the upper portions of the limbs, and the shoulders and haunches were black. The facial pattern, however, was not to be made out with certainty until a week or more later, when the characteristic pale cheek stripe could be seen. The ears were small and rounded, adpressed at first, and did not present any pencils until the age at which it first peeped from the box. The tail hairs too, are at first closely applied to the tail as in all young squirrels.

At the age of three months the young one is about one-third the size of its parents. It has erupted its incisor teeth, and these are probably its permanent incisors, since the deciduous predecessors, which are known to occur in *Sciuridae*, are always lost very soon after birth. It has not yet manifested its vocal powers, which are evident enough in both its parents.

I am indebted to Dr. R. K. Nair of the Trivandrum Gardens for the previous history of the specimens sent to me and to Miss A. K. Joshua for her co-operation in bringing the Squirrels to Colombo.

MEDICAL COLLEGE,
COLOMBO, CEYLON,
August 5, 1942.

W. C. OSMAN HILL, M.D., Ch.B., etc,

REFERENCE.

Hill, W. C. O., 1939.—On the Neonatus in *Ratufa* and *Funambulus*, Ceylon J. of Sc. (B), xxi, p. 189.

X.—DEFORMED TUSH IN A BOAR.

(With a plate).

A boar I shot in a beat a few days ago appeared to have only one tush on the right side protruding $3\frac{1}{2}$ in. from the gum. It was later discovered that the left tush was growing a couple of inches further back than the right one and lay parallel to and inside the teeth; it was not deeply imbedded in its socket and could be slightly moved; its forward end curved downwards and had made a hole or rather depression about $\frac{1}{2}$ in. diameter in the lower jaw. The boar was an exceptionally fat and hefty specimen of a hill boar. I should be glad to send you the jaw if you would care to have it.

RAM SINGH BAHADUR,

K.C.S.I., F.Z.S.

Maharawat of Partabgarh.

PARTABGARH (SOUTH RAJPUTANA).

August 19, 1942.

[His Highness forwarded the specimen to the society for examination. It is a most extraordinary form of malformation. The title of the note is somewhat misleading for what at first sight appears



Malformed Tushes of Wild Boar.

(*vide note*)

to be an abnormal tusk is in reality a most curious development of the second premolar of the left side of the lower jaw. The true tusk is completely suppressed and a very shallow cavity indicates its normal position. The bone in the area is somewhat spongy. The corresponding tusk of the right lower jaw is normal. The first premolar of the right side is normal. The corresponding tooth developed, but possibly due to the interference of the abnormal tooth was displaced and a shallow cavity, filled with bony tissue, marks its position. The second premolar of right side is quite normal. However, its partner on the left has developed into the form of a tush. The base of the tooth is thick; from its now-widened socket it bends forward and finally enters a somewhat deep cavity (about $3/8$ inch deep) which has been worn into the bone between the last pair of incisors. The tip lies crookedly within the cavity. From the base of the socket of the tooth, there appears a now-healed-up suture in the bone, which seems to show the path followed by the tip of the tooth at an earlier period, till it finally came to rest in its present position. The tooth was apparently loose in its socket as the cavity in which it rests is larger than otherwise necessary, but it cannot be extracted. All the remaining teeth are normal.

The abnormal tooth bears a scar which indicates where the upper tooth or teeth contacted it when the animal was eating. The lower jaw viewed from the underside shows no abnormality beyond the fact that the usual bulge in the bone necessary to accommodate the tusk (of the left side) is not developed.—Eds.]

XI.—SOME EXPERIMENTS IN ALBINISM.

(With a plate).

Some of your readers may be interested in my efforts successful after several attempts, to breed albino chital. The history is briefly as under:—

About four years ago I bought a chital stag in Bombay. I have always been interested in albinism, in any kind of animals or birds, and hearing that a 'White deer' was for sale at Crawford market, visited the unsavoury quarter where the animal dealers ply their trade. The dealer said he did not know what kind of deer it was; but I recognized it as a perfect specimen (except for the horns, which had no tines) of an albino chital stag and, cutting down the fabulous price demanded to less than half, secured it for a reasonable figure.

I placed this stag in my zoo and mated it to a normal doe; result was a normal female, which may be called exhibit (A).

(A) was in due course mated to her albino sire, result a normal female (B).

(B) mated to her albino sire, result normal male.

(B) again mated to her albino sire, result normal female (C).

(C) mated to albino sire, result normal female (D).

(D) also put back to albino sire and produced a perfect albino male (E) on 23-3-40.

(D) again put back to albino sire and has again produced another albino male (F) on 24-2-41.

It will be seen that doe (D) which is now apparently breeding 'true to type' is the fourth generation. I am hoping that in due course she will produce an albino female, which, if put back to the original albino sire, should definitely 'fix' the type.

I may add that the albino males (E) and (F) are typical specimens and have ruby eyes (which are rather intolerant of sunlight) pink noses, pink ears and light coloured hoofs. The original sire has horns about 2 feet in length with no tines; they are always in velvet, of a pink flesh colour, and the ends appear slightly raw. He drops his horns annually but the new ones grow in the same way. I enclose a family group photograph of D. E. & F.

As already mentioned, I am keen on albinos and have had perfect specimens of an albino black buck (from Jaipur jungles) and chinkara gazelle (from Dhrangadra). These died, in due course, and have been beautifully mounted entire by a famous firm of taxidermists; but, alas, the effect is somewhat spoilt by their being given normal black eyes and noses.

I have at present an albino female of the common-ringed parakeet (canary yellow, with ruby eyes) and a male blossom headed parakeet (orange, with light pink head and ruby eyes) I am trying to mate them. I also have an albino crow, just as big a villain as his normal corvine brother, an albino common mynah and albino 'moonias', also a pair of albino rhesus monkeys (all white with red faces and pink eyes and nails).

RAM SINGH BAHADUR,

K. C. S. I., F. Z. S.

PARTABGARH (SOUTH RAJPUTANA). *Maharawat of Partabgarh.*

August 19, 1942.

XII.—OCCURRENCE OF THE WHITE-CHEEKED BULBUL (*MOLPASTES LEUCOGENYS LEUCOTIS*) IN THE C.P.

On the 15th September 1942 a female White-cheeked Bulbul (*Molpastes leucogenys leucotis*) was killed by a field-collector at Nagpur. The specimen has been mounted for display in the Bird Gallery of the Museum.

As this is a very rare bird in this part, probably the first recorded from the south of Narbudda, I am reporting the matter in case you desire this information for record.

S. S. PATWARDHAN,

Curator.

CENTRAL MUSEUM,

NAGPUR,

September 16, 1942.



Foreground : Albino Chital (male, E)

Albino Chital fawn (male, F)

Chital doe (normal colouration, D).

In the background the original albino sire.

XIII.—THE OCCURRENCE OF THE COMB-DUCK (*SARCIDIORNIS MELANOTA*) IN MYSORE STATE.

As being of possibly some interest for your records, I would like to report that I shot a Comb-Duck (male), on the 30th November 1941, in the neighbourhood of Gundalpet, Mysore State.

The bird was one of four seen on the tank (probably two pairs).

I understand from Major Phythian-Adams that although he believes that he has seen these birds in the Mysore State in former years, he was not aware that one had actually been shot.

A solitary specimen of the Great Indian Bustard was seen the same day, but efforts to bag it proved unsuccessful.

'LANSDOWN',

R. F. STONEY.

OOTACAMUND,

July 11, 1942.

XIV.—THE BIRDS OF A BOMBAY GARDEN.

The war has put an end to the habit of social and duty calls hitherto practised, ardently or with reluctance, by Bombay Europeans and some others. But birds know nothing of war activities, and still less about petrol restrictions, and, with some notable exceptions, they have been if anything more assiduous than ever in putting in an appearance on my premises and attracting my attention to their existence and their charms. I am hoping that I may be allowed to repay their politeness by giving an account of them in this, I presume, friendly *Journal*. As several of them have never been in my garden before, and some have never even been seen in Bombay island before, I consider that their presence, however fleeting, deserves to be recorded.

I ought perhaps to begin by saying that I am well placed for visits from birds. My house, though unfortunately it is not actually mine, overlooks Back Bay. It has the hanging gardens immediately below it, and on one side what used to be the Ladies' Gymkhana, now almost entirely derelict, and on another side the flat Phirozeshah Mehta garden, covering a water reservoir, and beyond that the grounds of the Towers of Silence, which include a large area, well treed and mostly wild. Besides this, my garden, on both sides of the house, contains a good many trees, and there are many more on and across the roads outside. Not far away to the south are the grounds of Government House, and as most of the houses and buildings on Malabar Hill have well kept and well timbered gardens or compounds, the forty or so birds that I have on my calling list are probably fewer than might be expected. A human caller from Delhi treated the number with contempt. In his Delhi garden his bird acquaintances numbered eighty, he told me. Politeness, or slowness of wit, prevented my replying that in such a matter a compact and civilised city might well be expected to be beaten by a straggling up-country town.

Certainly there is nothing very remarkable about my ordinary residents. If there had not been some much more distinguished personages among my recent visitors I should not have ventured on this article. But before I speak of these I will list the humbler, but more constant friends that I really depend on for bird company.

My constant and unfailing companions are house crows, kites, mynahs, purple-rumped sunbirds, magpie robins, Mr. and Mrs. Koel, and a pair of rock-pigeons. Almost equally certain to put in an appearance, preferably when I can watch them at close quarters during the half hour that I am generally able to give to tea in the shadow of the bungalow on a small lawn that overlooks the Bay, are the coppersmiths (often numerous), iora, spotted fantail-flycatcher, white-breasted kingfisher, red-vented bulbuls, house sparrows, rose-ringed parakeets, palm-swifts, and, towards nightfall, Mr. and Mrs. Spotted Owlet. These, with one most important addition, the white-browed bulbul, whose cheery, rattling call rings out round the bungalow all day, make up my regular bird society. If I have counted them correctly they number nineteen.

Had I made this list two years ago I should have added the Indian robin and the Indian oriole. We used to see the latter frequently, and unless my memory deceives me we used to have the former also, but I certainly have not seen them, since, for now just about two years, I have taken to watching systematically.

Over and above these faithful nineteen a further nine birds take an interest either in me or my surroundings sufficient to bring them here pretty constantly, and to establish a considerable degree of familiarity between us. These are the bee-eaters, present, often in numbers, from October to the end of the year, when for some reason or other they forsake me though remaining in the neighbourhood until the monsoon. Besides the bee-eaters there are the red-whiskered bulbul, drongo, grey and white wagtails, Bombay rufous babbler, white-throated babbler, spotted munias and jungle crows. I must confess that this season I have only once or twice been looked up by a grey wagtail and not at all by any white ones. I cannot account for this, for both species used to be our constant tea-time companions. *Per contra*, the spotted munias and white-throated babblers, whose visits, always in little parties, we used to consider a very special favour, have been here again and again throughout this last cold-weather, and I often see a party of the former flying by. Presumably they know when I have anything worth stopping for, just as the white-throated babblers seem to have a genius for discovering when my *mali* has created a suitable bathing puddled at the foot of an oleander which they treat as a convenient, and modesty ensuring bathing box. All attempts on our part to establish a regular bird-bath have failed; it was invariably taken possession of by crows and kites, and caused a noticeable reduction in the visits of our smaller friends.

From this list of our residents and visitors there are at least two notable absentees. Brahminy mynahs undoubtedly inhabit the gardens and roads of the western, sea-face, side of Malabar Hill, but they totally ignore us on the eastern, Back Bay side. Is this some subtle social distinction that I am too simple-minded to grasp? Do they write their names at Government House, I wonder, or is

their caste too high even for that? Can it be that they are Congress birds, and subject in their social relationships to unnatural inhibitions from afar?

Another notable absentee from the list as so far given is the rosy pastor. He brings me to my once-or-twicers, the last five of whom are the real excuse for this article. With a name like his he might have been expected to be frequently seen at a house called Bishop's Lodge. But only once has he paid his duty call, and then with only a single companion. That was at the end of March last year, when at Colaba I had seen many of them, and at Kurla, at sunset, many hundreds. Another bird remiss in its attentions is the purple sunbird. I think I glimpsed him once, but am uncertain, whereas from Salim Ali's book, shortly to be mentioned, they appear to be not infrequent in the island. Other rare visitors have been paradise flycatchers and pied crested cuckoos, on all occasions towards the end of the hot weather, when no doubt they are on the move up the coast. The flycatchers have always been in the chestnut stage of feathering, but the last seen (this year), though still chestnut clad, had developed the long tail-feathers.

And now for my special and most honoured visitors, considered to be such on the authority of information derived from Salim Ali's *Birds of Bombay and Salsette*. If only every separate part of India had authoritative and exhaustive lists like this one, how much easier life would be for all who like myself desire to be able to put names to faces, however occasionally or imperfectly glimpsed. I will put these special five visitors in a *crecendo*, or perhaps it should be a *diminuendo*, of grateful awe.

First, because they are so small, I put the party of white-eyes that visited the above-mentioned oleander last January. Salim Ali gives four references for their appearance on Malabar Hill, but EHA, our other and older authority for Bombay, confesses to have never seen them on the island, though he considered them common in the cold-weather across the harbour.

Next, I had in December a series of late evening visits from a white-bellied drongo. EHA attributes him to Bombay, but Salim Ali does not bring him nearer than Tulsi Lake. He did not sit so still as the ordinary drongo does, but kept pouncing upwards into the air, uttering a sharp cry each time. He is smaller than the other drongo.

January, which brought the white-eyes, brought also an Indian shikra. He came in the middle of the day, but fortunately perched where I could see him from the lunch table, and gave me time to get quite near with a field glass. EHA describes him under the name Sparrow Hawk, and evidently considered him a common Bombay island bird, but SA (if I may call him that) has only two references for him, one in the city and one on Malabar Hill. The island is much more thickly built on than in EHA's time, and this and other birds have become rare; I think my pride in my shikra is justified.

Still more so is my pride in my Peregrine Falcon; yes, the real article, as aristocratic as anything could be, *Falco peregrinus peregrinus*. He was a tea-time visitor and stayed for a quarter of an hour, and then, when the crows became too impertinent, sailed away

with a most beautiful liquid flight, down towards Chaupatti, and then back to settle, presumably, somewhere further along the hill out of my sight. The fleckings on his breast resembled large and numerous drops of gravy. Mr. Prater assures me that these show that he was a young bird. From the skins I was shown the markings on the breast evidently vary much in different specimens. Though not uncommon on the neighbouring mainland coast he is not recorded to have been seen in the island before.

The final visitors on my list are three large cuckoo shrikes, one by itself in January and then two together in March. They are largish birds, and the first was hunting assiduously through a series of trees. In Whistler there is no picture, and the one in *The Handbook of Indian Birds* does not show the fine, pale crosslines on the breast that all three birds displayed. Salim Ali has no references for Bombay island and considers them uncommon in Salsette, but EHA says that he had frequently seen them on Malabar Hill.

Though this exhausts the birds that I have so far seen in my garden the list does not include all that can be seen from it. From November to March, for instance, there are constantly gulls on Back Bay, especially when fishing is in progress. The brahminy kite is constantly about in the monsoon. A pond heron once flew by at close quarters; our puddle is too insignificant and ephemeral for the likes of him. The vultures that belong further down the hill only occasionally soar into sight. There are two kinds, and why they are not more often in the sky I cannot imagine, just as I can form no theory to account for the flittering about of palm-swifts on some evenings but not on others. Two vultures once settled in a brab palm in full sight of our verandah, as though considering its suitability for a nest or roosting place. I should not have welcomed them as neighbours, and I am glad to say they never came again.

Before I end I should like to mention a few more birds seen recently on Bombay island. Kestrels, though they have abandoned the Marine Lines reclamation now that it is built over, are still to be seen at Colaba, where also, pretty frequently I think, the marsh harrier shows himself. A pair of blue rock-thrushes continue to inhabit for the present the southern of the two Worli hills. I say a pair though I have only once seen the hen, and on that occasion the cock, with his usual lack of sociability, was completely ignoring her. At the foot of the hill I thought I had this year a desert wheat-ear, and I still think it was one, as it was larger than the very similar bush-chat that was there next time I called. On the fore-shore at the foot of the same hill, I am sorry to say a particularly noisome piece of fore-shore, owing to the Lovegrove outfall, I had a year ago, at the end of May, and late in the evening, a flock of golden plover. SA speaks of these as frequent in the neighbourhood though never seen by him on the island. EHA, who must have known that they had been shot at Worli and on the flats and race-course of those days, seems doubtful whether they were likely to be seen. Now that the southern hill at Worli is being dug away for an esplanade and development in terraces, how much longer will these three birds be seen?

In search of waterside birds I visited last November the tidal pans and flats that lie between Antop and Trombay hills. There I had my one and only sight of a redshank. SA considers that it is not abundant in these parts, and has no island references for it. He is a beautiful bird on the wing, and as we were able to stalk him we had a good close up view of the curious way in which, when stationary, he ducks his head as though trying to swallow or regurgitate some morsel. The action is usually described as a bobbing of the tail. It is not that, though the tail, what there is of it, necessarily goes up when the head and forepart of him go down.

Just beyond the place where this bird was seen runs the tidal creek that used to connect with the Bandra creek and justify Bombay being called an island. Beyond the creek, in some small Pilu (*Salvadora*) trees, I came upon a party of white-cheeked bulbuls, crestless, and except for their yellow vents looking more like much overgrown cock-sparrows than anything else. Only a short time before, I had seen them, or rather their crested relations, in similar trees in Cutch, and I was interested to find that Salim Ali considers that in the neighbourhood of Bombay they are either escaped cage-birds, or, as I much prefer to think, migrants from Gujerat. *Salvadora* is a tree for which they have a special *penchant*. It is a waterside tree, often planted by Deccan wells, and very common in its natural habitat the sea-side of Gujerat and the North Konkan and on for some distance to the south. It is natural to suppose that birds would gradually work their way along the line of a favourite food plant. But *Salvadora* is supposed to be the mustard tree which our Lord says grows from the tiniest of all seeds to be big enough for birds to lodge in its branches. Were the birds He meant white-cheeked bulbuls, and can Bombay therefore claim to have two Bible birds, the other being Worli's Blue Rock-thrush, constantly thought, owing to its solitary habit, to be the bird that in the English translation of the Bible 'sitteth alone upon the housetops'? My authorities are inadequate to answer this question, but it is a highly suitable one with which to end an article from this particular pen.

RICHARD DYKE ACLAND.

BISHOP'S LODGE,
MALABAR HILL, BOMBAY,
June 12, 1942.

Postscript:—

Once again (for it has happened twice before) a bird has taken upon itself to upset what I have written, and has done so almost immediately after the manuscript had left my hands. It is a Brahminy Mynah that has played me the trick this time, whether with companions watching his escapade and egging him on from the background I do not know. He appeared in the garden early on the morning of June 16th, two days after the monsoon had started. He soon made off, and while here gave every indication of being on unfamiliar ground and in an uneasy state of mind or conscience.

R. D. A.

XV.—CAN HILSA BE TAKEN WITH ROD AND LINE?

With reference to the enquiry regarding *Hilsa* in the last number of the *Journal of the Bombay Natural History Society* (Vol. xliii, p. 266). The *Hilsa* feeds on plankton (microscopic organisms) and its gill-rakers are setose, acting as a sieve to filter out these minute particles of food. It will thus be clear, from the nature of its food and feeding habits, that rod and line cannot be used for catching this delicious fish. The fishermen of Bengal are very clever and if *Hilsa* could be secured on rod and line, they would certainly have used baited hooks for its fishery long ago and not left it to be 'caught in nets of a somewhat curious shape and *modus operandi*'.

EDITORS.

XVI.—THE MONITOR LIZARD (*VARANUS MONITOR*).

Someone asked me a few days ago whether monitor lizards could swim. I said I thought some did and others didn't basing my remark on my limited personal experience of these reptiles.

The only two occasions on which I have seen monitors swim was first while I was fishing for mahseer at Gurmi near Harnai in the Sibi District. The lizard which was about 3 ft. 6 in. in length and of a brownish colour on top but light underneath was basking amongst some stones close to the water. I put down my fly rod and ran to catch it but it was quicker than I and ran up a mulberry tree. I climbed up after it but it jumped down from a branch some 8 feet from the ground and made for the water into which it plunged swimming easily like a crocodile down into some weeds where it remained submerged for at least 10 minutes, after which I resumed my fishing, not seeing it again.

The second occasion was while I was making my way up a small tributary of the Indus near Thor in Chilas. The monitor on this occasion too was of the same brownish colour and measured about 4 feet including its tail with which it lashed me across the right shoulder when I caught it. I released it near the stream to see whether it would swim and it ran into the water remaining close to the bank but completely submerged.

I mention these two instances because I understand that the Water Monitor (*Varanus salvator*) is not found in India outside Bengal and possibly Assam while the Common Monitor (*Varanus monitor*) which is found all over India is alleged to be 'Terrestrial, living in holes in dry places' (*Fauna*). The Yellow Monitor (*Varanus flavescens*) which is found in North India too is said to be 'Terrestrial' (*Fauna*). Possibly common monitors (which I think these two were) only take to water when pursued by an enemy. Nevertheless the species whatever it may be certainly seems to be amphibious.

QUETTA,
BALUCHISTAN,
July 2, 1942.

R. K. M. BATTYE,
Capt.

[The Common Monitor may certainly be referred to as amphibious as it readily takes to water and can remain submerged for a considerable time. It also hunts crabs in streams and it has been known to even enter the sea when on islands. Eds.]

XVII.—THE FOOD OF THE BLIND SNAKE (*TYPHLOPS ACUTUS* BOULENGER).

As far as I am aware nothing definite appears to be known about the diet of the *Typhlops* in general. Wall (*Journ. B.N.H.S.* xxv, p. 375) merely makes a general statement, 'They live for the most part beneath the soil, and subsist upon worms, grubs and insects.' The usual habitat of the various species, at least during the monsoon months, under stones and in decaying timber has often led me to the belief that *Typhlops* lives principally on the eggs, pupae and larvae of ants. Incidentally, such habitats are common to ants during the same period as they are often swamped out of their underground nests, and is the best period to collect series of these *Hymenoptera* for research work. On September 12 Mr. H. Abdulali brought in a specimen of *T. acutus* which on being put into a preservative vomited what it had eaten. An examination of the substance revealed that it was composed of nothing but the eggs and pupae of ants. This fact confirms my original belief so far as this large species is concerned. The question naturally arises as to how the *Typhlops* is able to obtain the eggs and pupae from the formicid owners which are very often very pugnacious and attack everything that disturbs their peace.

BOMBAY NATURAL HISTORY SOCIETY,

C. McCANN.

BOMBAY,

September 16, 1942.

XVIII.—THE KING COBRA (*NAIA HANNAH*) IN CAPTIVITY.

Ditmars in his *Snakes of the World*¹ has given a rather detailed account of King Cobra (*Naia hannah*) which is regarded by him as the star snake of the Indo-Malayan area. Interesting observations on the feeding habits of this cannibalistic serpent are also made by Boulenger in the popular book *The London Zoo*.²

The King cobra has been known to occur in the Cochin State forests for over 23 years, and the State Zoo at Trichur has always had one or more specimens in captivity during this period. The first specimen was captured from Kanhirapilly in 1919 and lived for over twelve years in captivity. It is reported that the authorities then had great difficulty in feeding this snake as they had no idea for some months that it lived upon the common rat snake. But, once the proper prey was discovered, there was no difficulty in keeping the snake in captivity. The King Cobra was also regarded as very rare in the Cochin forests till 1936, when as many as three specimens were procured for the Zoo, one from Chalakudy and one each from Pattikad and Thanikudam, localities not far from Trichur. Specimens were also collected in the years 1937 and 1938 from other adjacent localities. But none of these lived in the Zoo for more than a year and their deaths were attributed to injuries received during capture and in one case probably due to in-

¹ New York, The Macmillan Company, 1937.

² London, J. M. Dent & Sons, Ltd., 1937.

anition caused by complete abstinence from food. This young snake, unlike others that broke their self-imposed fasts after some days or months of captivity, persisted in refusing food until at last even artificial feeding with beaten eggs was of no avail.

The loss of a number of specimens made me bestow careful attention on the surviving ones. The dates of feeding were noted in each case and daily observations were made to find out whether the snakes were showing signs of ill health. While most specimens resorted to hunger strike when put under artificial conditions, an apparently healthy snake, captured from Vellankara Estate, after one year of captivity, during which period there was no difficulty at all in feeding it, developed a strange illness. It was first noticed when the snake ceased to shed its skin, the periodical renewal of which is essential for the health and activity of reptiles. All attempts to induce the snake to cast its skin by making it pass through the granite locks kept in the cage were without success and the condition persisted till it ended fatally.

There was only one more specimen left in the Zoo and this in its turn began to show signs of inactivity and long intervals in shedding its skin after an year of captivity. The snake was also continuously off its feed for over two months and judging from previous experience its life was evidently in danger. The only course open to the Zoo staff was to peel off the dead skin by artificial means. One of the experienced keepers volunteered to carry out the operation and curiously enough the snake seemed to like it very much. The snake regained its activity when the dead slough was removed, and before long captured a live rat snake as usual.

After about six months of normal life the condition again recurred. This was during the rainy season and the chillness of the weather seemed to add to its inactivity. The idea of warming the snake by some arrangement suggested itself and was carried out with complete success. The snake appreciated the amenity of artificial heating of its cage and readily coiled itself near the improvised oven. After a couple of days the scales began to come off, the snake started moving about and was evidently in search of food. A small-sized rat snake kept pressed to the cage by a long stick whetted its appetite and was readily caught. Larger specimens given during the succeeding weeks were caught without difficulty and the snake again became the unique exhibit of the reptile house attracting the usual crowd on feeding days. The process of removing skin by artificial means was resorted to a third time during the hottest part of the year when the snake again became very inactive and refused its feed.

The experience in keeping King Cobras in the Zoos has thus led me to think that most of these giant reptiles find it difficult to slough of their own accord after some months of captivity and that, unless efforts are made to remove the epidermis artificially, the snakes become ill, refuse to capture their prey and die.

M. GOVINDAN KUTTY MENON, M.A.,

STATE MUSEUM AND ZOO,
TRICHUR,
July 6, 1942.

Superintendent,

XIX.—NOTES ON THE BREEDING HABITS OF SOME
SNAKES.

(With a plate).

Five snakes in the Reptiliary of the Zoological Gardens, Trivandrum, laid eggs within the last half year. Reference has already been made on p. 108, vol. xliii of this *Journal*, about one of these, the chequered water snake (*Nerodia piscator*) which as reported has laid the record number of eggs (91) observed for the species. The others that had their breeding season during this period were two pythons, one wolf snake and one krait. Attempts have been made to incubate the eggs of all these snakes, but hatchlings were obtained only in the case of *Nerodia*. Of the latter it might be mentioned that Major Wall says in his 'Popular Treatise on the Common Indian Snakes' that all attempts to incubate them have proved futile (*J.B.N.H.S.*, vol. xvii, p. 864). In case it might be of interest to the readers, I am giving below, details of observations made regarding the breeding season, number and size of eggs of each clutch, period of gestation and period of incubation as far as has been ascertainable.

The Python (*Python molurus*).—Two individuals of this species laid eggs, one on Feb. 19, and the other on March 19, 1942. In both cases the snakes soon after the commencement of the process of discharging the eggs coiled themselves round them. The number of eggs in the clutch of the former was 21, and of the latter 22. An egg measured $3\frac{1}{4}$ in. by $2\frac{1}{2}$ in. They were white in colour when laid, but later on turned brownish white. Though on previous occasions eggs have hatched out here, this time both the snakes moved away after nesting over the brood for a few days. While one of these was 'brooding' a fowl was let into the cage for feeding another python which was lying about 3 yards away in the same cage. The 'brooding' one at once darted forwards and caught hold of the fowl and commenced swallowing. After the feed it turned away from the eggs and subsequent attempts to coax it back to its clutch failed. The pythons while remaining coiled over the eggs were found to make jerky movements at regular intervals of between thirty seconds to one minute.

The Chequered Water Snake (*Nerodia piscator*).—This snake was admitted to the Reptiliary on the 24th November 1941, and has been in captivity since then without a mate. It laid eggs on the 29th January 1942. The period of gestation therefore cannot be less than 67 days which have intervened between its capture and the discharge of eggs. Major Wall mentions 55 days as the period of gestation for this species as observed by him. It took more than 12 hours for the reptile to void all the eggs (91) after which it remained inactive for a long time, its tail resting on the brood. The eggs were removed the next day, counted and placed in a glass jar over loose earth, covering the eggs with wet earth. The jar was so placed that for a couple of hours during the day direct rays of the sun might get access to it through the window of the Reptiliary. The earth was kept moist by occasionally sprinkling

water on it. In the meanwhile the mother had taken to its regular feed, shed its skin and to all appearances was quite unconcerned about the eggs. A few eggs hatched out on the 10th of March. The young ones were very inactive at first, but when put into water became very active and were swimming about. About 16 young ones were hatched out by the 12th March. The other eggs had begun to decay and were therefore removed. Many of these had fully developed embryos inside. Attempts to rear up these young ones failed and all of them died one after another during the succeeding few days. A hatchling as it emerged from the egg measured 7.2 ins. The period of incubation for the eggs of this species may be taken as 41 days.

The Wolf Snake (*Lycodon aulicus*).—A snake of this species was caught in a well on the 2nd June and brought to the zoo. It laid four eggs on the 3rd. After laying, it crept up to a corner of the cage and remained inactive for the two succeeding days. Even though it came down later it was not observed to feed on the small frogs which had been let into the cage. The snake was found dead on the 10th morning. It measured 19½ ins.

The Common Krait (*Bungarus caeruleus*).—A female measuring 3 ft. 4 ins. has been in captivity here since December 15, 1941. It laid 8 eggs on the 15th February 1942, 63 days having elapsed since its capture. Its mating must therefore have taken place in November or early in December. Major Wall has mentioned that its exact mating season has not been ascertained but he puts it down as probably during the months of February and March (vol. xviii, p. 722). Prior to laying, the krait built a sort of hollow nest in the sand on the floor of the cage and the eggs were voided into this depression. The eggs were white, glossy and elliptical, an egg measuring 1.3 ins. in length and 0.6 in. in breadth. The mother after laying, coiled itself round the eggs, even though the 'nesting' was not as compact as in the case of the Python. After a week it moved away and the eggs on examination were found to have shrunk considerably. Within the next two days they began to decay. This might probably be due to unfavourable weather conditions. According to Major Wall, the female after discharging her eggs remains coiled up with them at any rate until they are well advanced towards incubation. In this case none of the eggs which were examined after the mother had moved away, had developing embryos inside.

TRIVANDRUM,

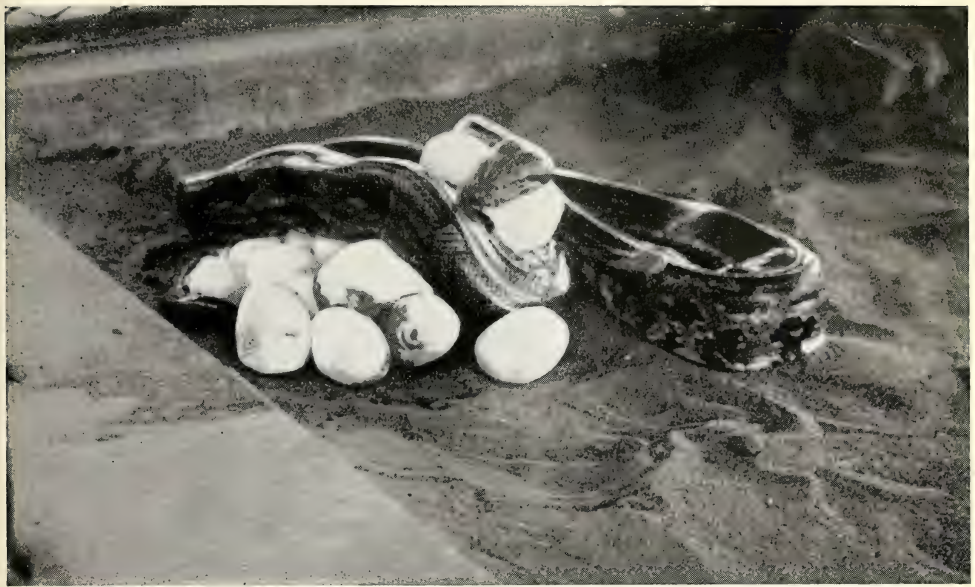
June 15, 1942.

E. S. SIMON.

XX.—RIVER POLLUTION AND FISH MORTALITY.

During the recent heavy rain in the Rawalpindi District many of the rivers have come down in flood and it has been a most distressing sight to see the quantities of fish that have been killed by the polluted water from the Leh River.

The Leh River as you may know is a small river draining the Pindi district and having no source in the hills. It joins the Sohan River a hundred yards below where the Trunk Road crosses both



Python with its eggs.



Python brooding over its clutch.

rivers about 4 miles from Rawalpindi. I have seen no dead fish in the Sohan above the junction with the Leh so it is fair to assume that pollution must come from this river.

Last week we had a very local storm which brought the Leh down in flood but which had very little effect on the Sohan. The result was appalling. From the junction and right on down to below Morgah Village dead fish were stranded as the water fell. In one reach alone I counted over thirty large fish of over 1 lb. and many more between $\frac{1}{2}$ and 1 lb. The biggest fish was about 5 lbs. It was most noticeable that there were very few small fish or fry and no really large ones. If this destruction occurs every time the Leh floods I am afraid it will be the end of the Sohan as a fishing river.

The cause of the pollution is doubtful; discharge from a Brewery or a Chemical works would seem to be the cause, but this has not been proved to my satisfaction.

You will agree that it really is a very great pity and a complete disaster to myself as I am a very keen angler and with petrol rationing one naturally has to make use of the river nearby for all one's sport.

Is there anything that can be done? As a keen member of the Society I feel that you could advise what authority would take this up.

I cannot tell you if this has happened before this year but the local fishermen say that this year they have never seen so many dead fish so I presume it has happened before but not to this extent.

Any further information will be most gladly given.

RAWALPINDI,

F. R. E. MALDEN.

July 23, 1942.

[Dr. Hamid Khan, Game Warden, Punjab to whom we referred the matter wrote as follows:—

With reference to your letter dated the 31st July, 1942, I have to intimate you that the river pollution and destruction of fish in the Rawalpindi area has been under investigation for the last year or so. It was observed that discharge from the Attock Oil Company's refinery was responsible for the heavy mortality of the fish. A sample of water collected directly from the nala into which the waste product of the refinery was discharged was analysed by the Head of the Chemistry Department of the Gordon College, Rawalpindi and it was found that the water contained kerosene oil, excess of free acid and other injurious constituents harmful to all living beings including fish. A copy of the analysis is enclosed herewith. The Manager, Attock Oil Company has been requested to take necessary steps to remove the source of pollution.

REPORT OF ANALYSIS.

*Water sample submitted by Inspector of Fisheries on 5-7-41.
Physical Characters.*

Colour — Dirty White.

Suspended Matter — Present (High).

Taste — Bitter and Offensive.

Odour — Strong, offensive, smells of kerosine oil.

Reaction — Strongly acidic.

Chemical Characters. Parts per 100,000.

Chlorine — 12.4.

Sodium Chloride — Chlorine \times 1.647 = 20.47.

Free Acid — 25.

Total Hardness — CaCO_3 — 76.

Temporary — Nil.

Permanent — 76.

Sulphates — High.

CaO — Nil.

Free CO_2 — Nil.

Iron — Very High; Copper — Absent — Lead — Absent.

Nitrates — Nil.

Total Solid Matter dried at 100°C = 160.

Remarks.

The sample is entirely unfit for human consumption and for all other animals due to the presence of high percentage of Iron, Free Acids, Kerosine Oil and large percentage of other impurities reported above.—EDS.]

XXI.—GLOW-WORMS (*LAMPHROPHORUS* SP.)

FEEDING ON MOLLUSCS.

In volume xliii, p. 109, Mr. R. E. Parsons records a Glow-worm (*Lamphrophorus nepalensis* H.) feeding on a slug. It may be of interest to record that I have frequently come upon species of glow-worms feeding on land snails. However, the following incident is worthy of note:—

Some years ago the late Fr. Blatter while at Panchgani kept a large glow-worm in a bottle and fed it regularly on land snails. The glow-worm would enter the shell and eat out its victim. The snail would exude a considerable amount of slime till finally the glow-worm was almost completely enveloped in slime. It did not seem to mind the coating of slime at all and went on with its meal. The specimen concerned lived in this way for a little over two years and looked perfectly healthy. Prior to her death she laid two or three largish elliptic eggs about 5-6 mm. in length and somewhat pale pink in colour.

During the rains several species of glow-worm are fairly common in the Western Ghats.

BOMBAY NATURAL HISTORY SOCIETY,

C. McCANN.

BOMBAY,

May 1, 1942.

XXII.—THE BUTTERFLY *DIAGORA NICEVILLEI*.

With reference to my account of *Diagora nicevillei* in last December's *Journal* (xlii, p. 819) where some doubt was thrown on the sex of the type of this butterfly which is in the Indian Museum at Calcutta, I quote the following from a letter received from Dr. Baini Prashad, the Superintendent of the museum: 'We have again examined this specimen in reference to the structure of its leg. Fortunately the left foreleg is complete, and this resembles exactly that of a male Nymphalid—the tarsus is distinctly very hairy unlike that of a female. There can, therefore, be no doubt that it is a male.'

This being so, the specimen collected by me in Nepal is very likely a new sub-species.

When it is possible to obtain specimens of the unknown sexes of both De Niceville's and of my species, or to make a careful comparison of the actual specimens available it may be necessary to assign a new name to the Nepal specimens.

HILL HOUSE, NORTHREPPS,
CROMER,
NORFOLK,
May 18, 1942.

F. M. BAILEY,
Lt.-Colonel.

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Cup and Saucer Plant
HOLMSKIOLDIA SANGUINEA Retz.
(nat. size).

JOURNAL OF THE Bombay Natural History Society.

1943.

VOL. XLIII.

No. 4.

SOME BEAUTIFUL INDIAN CLIMBERS AND SHRUBS

BY

N. L. BOR, M.A., D.SC., F.L.S., I.F.S.,

Forest Botanist,

AND

M. B. RAIZADA, M.SC.,

Assistant Forest Botanist,

Forest Research Institute, Dehra Dun.

PART XIII

(Continued from Vol. xliii, No. 3 (1942), p. 297.)

(With 1 coloured plate and 9 text-figures.)

VERBENACEAE, PART II.

4. *Holmskioldia* Retz.

(A genus erected in honour of Theodor Holmskiöld, 1732-1794, a Danish scientist).

Scandent shrubs with opposite, exstipulate, simple leaves. Flowers arranged in terminal short panicles or spurious axillary racemes. Calyx membranous, usually red, the tube very short, the limb large, rotate and spreading, entire or nearly so. Corolla gamopetalous, tubular, the tube elongate, slightly curved, somewhat dilated at the throat, 2-lipped; upper lip 2-cleft with the lobes erect spreading, the lower 3-cleft with short reflexed lobes. Stamens 4 didynamous, exserted. Ovary 4-celled, with a solitary ovule in each cell; style filiform. Fruit a 4-3-2-lobed capsule surrounded at the base by the large flat calyx.

Holmskioldia sanguinea Retz.

Cup-and-Saucer Plant.

(*sanguineus* means blood-coloured and refers to usual colour of the flowers).

Description.—A large, scrambling shrub; young parts pubescent. Leaves opposite, 2-4 in. long, ovate or elliptic-ovate in shape, rounded or truncate at the base but acute at the insertion of the petiole, shallowly crenate serrate on the margin; acuminate at the tip, membranous in texture, dark green above, pale beneath, glabrous on the upper surface, minutely pubescent below when young; petiole slender, up to 1 in. long.

Inflorescence a terminal, puberulous, little-branched panicle or reduced to short racemes at the tips of axillary, short shoots. Calyx gamosepalous, almost orbicular in shape from a very short, basal, bell-shaped portion, .6-.75 in. in diameter, net veined, reddish or orange in colour, finally turning brown in fruit. Corolla about 1 in. long, gamopetalous, tubular; tube curved, 2-lipped; upper 2-lobed, lower 3-lobed. Stamens 4, didynamous, exserted; anther-cells parallel. Ovary 4-celled; ovule 1 in each cell; style slender; stigma bifid. Fruit a drupe, obovoid in shape, deeply 4-lobed at the apex, separating into 4 seeds.

Flowers.—October-December.

Distribution.—Native of the sub-tropical Himalayas. Often cultivated in gardens throughout India.

Gardening.—A straggly shrub, remarkable for its large subrotately-campanulate red calyx reaching an inch in diameter in fruit. The plant will grow even in poor soil and does best in full sunshine. It is advisable to prune it closely after flowering so as to keep it compact and within bounds. This plant is very popular for cut flowers for even when the corolla has fallen the calyx is pretty and very effective. Usually propagated by layers as cuttings are sometimes hard to start.

A variety with orange flowers has recently been introduced from Assam where it is wild. It is prettier than the type.

5. Clerodendron Linn.

The name of the genus comes from two Greek words, *kleros*, lot, fate, and *dendron*, tree. The combination may mean 'tree of fate' or 'tree of chance'. The reason for the application of the name to the genus is obscure, but it may well come from the fact that some of the species are considered to have healing properties while others act in exactly the reverse way. According to Burkill¹ 'Clerodendrons are, par excellence, plants of Malay magic'. He then proceeds to give examples and mentions that *C. siphonanthus* is the chief magical species of northern India. The alleged magical properties of the plant may have also been a reason why the genus was called 'tree of fate'.

¹ A Dictionary of the Economic Products of the Malay Peninsula.

A large genus, distributed more or less throughout the tropics, it possesses the following characteristics:—

Trees, shrubs, undershrubs or rarely herbs. Leaves simple, opposite, rarely verticillate (see *C. siphonanthus*.) Inflorescence usually a terminal panicle, less often of axillary cymes, usually lax, elongate or umbelled or capitate; bracts often foliaceous; flowers mostly large, white, blue, yellow or red. Calyx cup-shaped, campanulate or funnel-shaped, herbaceous or coloured, truncate or with 3-5-lobes, often enlarged in the fruit. Corolla with a slender tube, often very long, cylindrical, recurved, 4-5-lobed; lobes spreading, almost equal. Stamens 4, exserted, inserted in the throat or in the upper portion of the tube, coiled in the bud; anthers with parallel cells, opening by longitudinal slits. Ovary incompletely 4-celled; ovules 4, pendulous or laterally attached. Style slender, often as long as the filaments, stigma shortly bifid. Fruit a 4-grooved or 4-lobed drupe.

The *Clerodendrons* are great favourites in Indian gardens on account of their showy flowers and often handsome foliage. They never show to such an advantage as they do in their natural homes in the gloom of the evergreen forest where they develop their beautiful panicles to perfection.

KEY TO THE SPECIES.

- | | |
|--|------------------------------|
| Tube of the corolla 4 in. long. | ... <i>C. siphonanthus</i> . |
| Tube of the corolla 2 in. long or less. | |
| Climbing plants. | ... <i>C. Thomsonae</i> . |
| Shrubs or small trees. | |
| Calyx truncate or very shortly toothed. | ... <i>C. inerme</i> . |
| Calyx distinctly lobed or dentate. | |
| Flowers red or scarlet. | ... <i>C. squamatum</i> . |
| Flowers white or rose. | |
| Calyx with peltate glands. | |
| Calyx-lobes triangular acute. | ... <i>C. fragrans</i> . |
| Calyx-lobes broadly ovate, foliaceous. | ... <i>C. infortunatum</i> . |
| Calyx without peltate glands. | |
| Flowers in a pendulous panicle. | ... <i>C. nutans</i> . |
| Flowers in erect inflorescences. | |
| Flowers in trichotomous panicles; leaves | |
| large, 6 in. long or more. | ... <i>C. trichotomum</i> . |
| Flowers in dichotomous panicles; leaves | |
| small, 2 in. long or less. | ... <i>C. phlomidis</i> . |

Clerodendron siphonanthus R. Br. (*C. indicum* O. Ktze).

Turk's turban; Tube-Flower.

(The specific name is derived from the Greek word, *siphon*, tube, and refers to the hollow stems of this plant.)

Description.—An annual shrub reaching 9 ft. in height. Branches channelled; bark smooth and shining. Leaves verticillate in threes

or fives, or opposite, sessile, narrowly lanceolate or oblong-lanceolate, attenuate at both ends, glabrous on both surfaces, entire with recurved margins, membranous, 4-8 in. long by .5-1 in. wide.



Fig. 1.—*Clerodendron siphonanthus* R. Br. $\times \frac{1}{2}$.

Flowers arranged in a leafy, terminal panicle, 8-10 in. long, made up of verticelled, few-flowered cymes; bracts linear-lanceolate, up to .5 in. long; bracteoles subulate; pedicels slightly hairy, up to .75 in. long. Flowers white, turning a cream colour, 4-5 in. long. Calyx campanulate, hairy, .6 in. long; tube narrow .2 in. long; 5-lobed; lobes ovate-lanceolate .4 in. long. Corolla glabrous; tube cylindrical, recurved, dilated towards the top, up to 4 in. long, 5-lobed, lobes spreading obovate or oblong, obtuse, .5 in. long or less. Stamens 4; filaments long exserted, slender, glabrous; anthers oblong. Ovary glabrous; style very long, slender; stigma shortly bifid. Fruit a bluish-black drupe enclosed in the enlarged calyx.

Flowers.—Rainy season. Fruits cold season.

Distribution.—Common in many parts of India and Burma extending to Malaya, Indo-China and Java. Often cultivated in gardens for its flowers.

Gardening.—A shrub which grows 4-8 ft. tall in Dehra, with a slender upright form which makes it attractive when grown against

a wall. The long, white, tubular flowers hanging bell-like from an upright stalk make this a very striking plan during the rains. The flowers are followed by conspicuous dark-blue fruits supported by the persistent, spreading red calyx. The plant prefers partial shade and is propagated by seed.

Medicinal uses.—The root is considered useful in the treatment of asthma, cough and scrophulous affections. Pieces of the wood are tied round the neck as a charm against various ailments. The juice expressed from the herbaceous portions mixed with ghee is used as remedy for skin diseases.

***Clerodendron Thomsonae* Balfour.**

(The specific epithet commemorates the name of the wife of the Rev. W. C. Thomson, a missionary on the West Coast of Tropical Africa, from where the plant was introduced into England in 1861).



Fig. 2.—*Clerodendron Thomsonae* Balfour. $\times \frac{1}{2}$.

Description.—A climbing shrub. Branches 4-angled, minutely pubescent. Leaves opposite, broadly ovate, acute at the tip, subcordate, truncate or abruptly attenuate at the base, minutely and sparsely pubescent below, entire on the margins, chartaceous, 2-3 in. long by .5-2 in. wide; petiole up to .6 in. long.

Flower arranged in axillary cymes; peduncles 1.5-2.5 in. long; bracts foliaceous, pubescent, lanceolate; pedicels bracteolate, up to .6 in. long; flowers scarlet. Calyx inflated, membranous, white or grey, .75-1.25 in. long by .4-1 in. wide; tube very short; lobes 5, broadly ovate-lanceolate, acute, glabrous or minutely pubescent near the margins. Corolla scarlet or red; tube widened

at the throat and hairy, 5-lobed; lobes ovate, .2 in. long. Stamens 4; filaments long exserted, slender; anthers oblong. Ovary glabrous; style not as long as the filaments.

Flowers.—Rainy season.

Distribution.—Native of west tropical Africa; commonly cultivated in gardens in the tropical and sub-tropical parts of the world.

Gardening.—A most ornamental climbing shrub, very showy during the rains with its scarlet flowers which are in sharp and striking contrast to the white persistent calyx. Propagated by seed or by cuttings in sand during the rains.

Clerodendron inerme Gaertn.

(*inermis* means unarmed in Latin, but to what this refers we are unable to say, as none of the species of this genus are armed).



Fig. 3.—*Clerodendron inerme* Gaertn. $\times \frac{3}{4}$.

Description.—A shrub reaching a height of 6-9 ft. Branches slender, greyish-brown, lenticellate, glabrous or finely pubescent. Leaves opposite, elliptic-ovate or ovate-lanceolate, rounded or shortly and obtusely acuminate at the tip, cuneate or acute at the base, entire, coriaceous, rarely membranous, 1.5-5 in. long by .75-

3 in. wide, when young sparsely pubescent; petiole slender, .3-.75 in. long.

Inflorescence of umbelled, axillary cymes, each of 3 pedicelled flowers, seated on a peduncle, .3-1.5 in. long. Flowers on pedicels 1.3-4 in. long, white, supported by small linear bracts. Calyx cupular, pubescent or glabrous, often glandular without, 5-toothed; teeth very small. Corolla glabrous or sparsely pubescent, glandular; tube slender, .75-1.5 in. long, villous inside, 5-lobed: lobes ovate, obtuse, .2-.3 in. long. Stamens 4; filaments slender, red, long exserted, inserted in the villous part of the tube; anthers oblong. Ovary glabrous; style long, slender, equalling the filaments in length; stigma shortly bifid. Fruit a glabrous, 4-lobed drupe, up to .5 in. long, enveloped in the striate, enlarged calyx.

Flowers.—Throughout the year but chiefly from July to November

Distribution.—Indigenous to the seacoast of India extending to Polynesia.

Gardening.—A straggling, almost scandent, evergreen shrub with dark green foliage and white flowers. It is a very hardy and quick growing shrub and is suitable for covering banks, walls, etc. If kept nicely trained it will form a pretty fence and is consequently very suitable for hedges. Owing to its rapid growth it might perhaps as well be useful for afforestation work.

Medicinal uses.—The wood, root and leaves are bitter and are said to be of use in treating fevers. It has a reputation as an alterative and tonic.

Clerodendron squamatum Vahl.

(*squamatum* means scaly in Latin and refers to the peltate glands on the under surface of the leaf).

Description.—A shrub attaining 6 ft. in height. Branches 4-angled, channelled, glabrous or finely pubescent, furnished at the nodes with a line of interpetiolar, woolly hairs. Leaves opposite, ovate-rounded, shortly acuminate at the tip, deeply cordate at the base, covered with stiff, sparsely arranged hairs, dark green above, pale and covered with numerous peltate glands below, chartaceous in texture, toothed on the margin; petiole glabrous, .2-.4 in. long.

Flowers pedicelled, scarlet, sometimes white or rose-coloured, arranged in pyramidal, terminal, broad, glabrous or pubescent panicles seated on long peduncles; bracts and bracteoles small; pedicels short. Calyx glabrous, red, .2-.3 in. long, 5-lobed; lobes much longer than the very short tube, broadly lanceolate-acute. Corolla almost glabrous; tube cylindrical .5-.6 in. long, 5-lobed; lobes spatulate .15-.2 in. long; stamens 4; filaments slender, long exserted: anthers oblong; ovary glabrous; style very long, slender; stigma shortly bifid. Fruit a blue-black drupe, up to .5 in. broad, within the accrescent calyx.

Flowers.—March-April.

Distribution.—Native of China, extending to the Himalayas, Japan to Sumatra, cultivated throughout the tropical and subtropical parts of the globe,

Gardening.—This is one of the most showy of shrubs, having great clusters of scarlet flowers which appear during March-April. It should be cut back after flowering, otherwise it becomes bare and



Fig. 4.—*Clerodendron squamatum* Vahl. $\times \frac{1}{2}$.

scraggy. The plant prefers partial shade and is often attacked by insects, especially mealy bugs and scales. It has been in cultivation in European gardens since 1790. Propagation is by seed.

Medicinal uses.—An infusion of the leaves in vinegar is said to be used for gonorrhoea, and the chewing of the bract for passing blood.

***Clerodendron fragrans* Vent.**

Description.—A shrub. Branches terete, somewhat quadrangular towards the tips, pubescent, almost tomentose. Leaves opposite, broadly ovate, nearly round, shortly acuminate at the tips, almost cordate, but sometimes truncate, at the base, covered with

rather sparse, stiff hairs above, pubescent, especially on the nerves below, glandular near the petiole, membranous, regularly toothed on the margins; 4-6 in. long and as much wide; petiole pubescent-tomentose, up to 2 in. long.



Fig. 5.—*Clerodendron fragrans* Vent. $\times \frac{1}{2}$.

Inflorescence of numerous flowers arranged in terminal, compact, almost sessile panicles; bracts foliaceous, persistent, lanceolate-oblong, attenuate at both ends, pubescent and bearing on the back a nectariferous gland. Individual flowers seated on very short pedicels, white or rose in colour, very fragrant, .75-1.25 in. long. Calyx conical, narrow, finely puberulent, with nectariferous glands, up to .5 in. long, 5-toothed; teeth as long as the tube, lanceolate-subulate, reflexed. Corolla double, glabrous; tube .5-.8 in. long, 5-lobed; lobes obovate, reflexed, .25-.4 in. long. Stamens 4; filaments long exserted, slender; anthers oblong. Ovary glabrous, truncate; style slender, very long; stigma shortly bifid. Fruit a drupe, enveloped at the base by the accrescent calyx.

Flowers.—Hot and rainy season.

Distribution.—Indigenous to China, cultivated or wild throughout India and most parts of the tropics.

Gardening.—A vigorous, low growing plant; flowers double, appearing like little roses, white tinged with pink, fragrant. It spreads readily, throwing out suckers here and there and trespassing beyond its allotted space. It prefers a moist shady place but is quite hardy and drought resistant. Easily propagated by suckers or cuttings. It was brought into cultivation in European gardens about 150 years ago,

Medicinal uses.—According to Burkill it is used medicinally by the Malays externally, either as a fomentation for rheumatism and ague, or with other substances in the treatment of skin diseases.

***Clerodendron infortunatum* Linn.**

(*infortunatus* means unhappy in Latin; but we do not know to what the epithet refers. Trimen says that this name is due to Hermann



Fig. 6.—*Clerodendron infortunatum* Linn. $\times \frac{1}{2}$.

(Mus. 25, 45) who translates the Sinhalese name 'pinna kole' as 'infortunatus').

Description.—A shrub. The quadrangular branches are channelled and covered with a yellowish pubescence. Leaves opposite, ovate, acuminate at the tip, rounded or cordate at the base, more or less covered with rough hairs, with small round glands on the lower surface, toothed on the margins, rarely entire, 4-10 in. long by 3-8 in. wide; petiole densely pubescent, 1-4 in. long.

Flowers arranged in a broad and long, terminal panicle; panicle-branches trichotomous each ending in three flowers, covered with a yellowish pubescence; bracts foliaceous, ovate-lanceolate, falling early; bracteoles lanceolate; pedicels slender up to .5 in. long. Flowers white, tinted with red, unpleasantly scented. Calyx silky-pubescent, covered with peltate glands, up to .4 in. long; calyx tube very short with acute, erect, lanceolate lobes. Corolla densely hairy without; tube cylindrical, slender up to .75 in. long, 5-lobed; lobes spreading, as long as the tube, the 2 upper spatulate, the 3 lower ovate-oblong, rounded at the top. Stamens 4; filaments long exserted, slender, glabrous; anthers oblong. Ovary glabrous; style slender; stigma shortly bifid. Fruit globular, shining, black, seated upon the enlarged, fleshy, red calyx.

Flowers.—January-April. *Fruits*.—Rainy season.

Distribution.—Throughout India; often as an undergrowth in sal forest.

Gardening.—A deciduous shrub reaching 12 ft. in height in favourable situations. It is usually considered to be a 'weed' but attractive during the cold season with its large head of pinkish-white, sweet-scented flowers. Propagated by seed.

Medicinal uses.—The juice of the leaves is stated to be anthelmintic, and is used as a bitter tonic in malarial fevers. The leaves warmed with ghee are applied to the head for catarrhal colds.

***Clerodendron nutans* Wall. ex Don.**

(*nutans* means nodding in Latin and refers to the terminal racemose panicles of this plant).

Description.—A shrub reaching 6 ft. in height. Branches quadrangular, glabrous. Leaves opposite or ternate, oblong-obovate or oblanceolate, shortly acuminate at the tip, long attenuate at the base, entirely glabrous, entire or distantly toothed on the margins, membranous, 5-8 in. long, by 1.5-2 in. wide; petiole channelled, .5-1 in. long.

Flowers arranged in pendulous, slender, terminal panicles. Individual flowers pedicelled, white; pedicels .75 in. long, with 2 bracteoles near the middle. Calyx ovoid, inflated, purple, glabrous, up to .5 in. long; tube very short, 5-lobed; lobes ovate-lanceolate, acute, reddish purple. Corolla glabrous or sparsely and finely pubescent; tube narrowed at the throat up to .5 in. long, 5-lobed; lobes ovate, rounded. Stamens 4, didynamous; filaments slender, long exserted, inserted in the throat; anthers small, ovate. Ovary small, glabrous; style shorter than the filaments. Fruit a globose drupe, smooth, shining, seated on the enlarged calyx.

Flowers.—September-November,

Distribution.—Sikkim, Assam, Chittagong and Burma, extending to the Malay Peninsula.

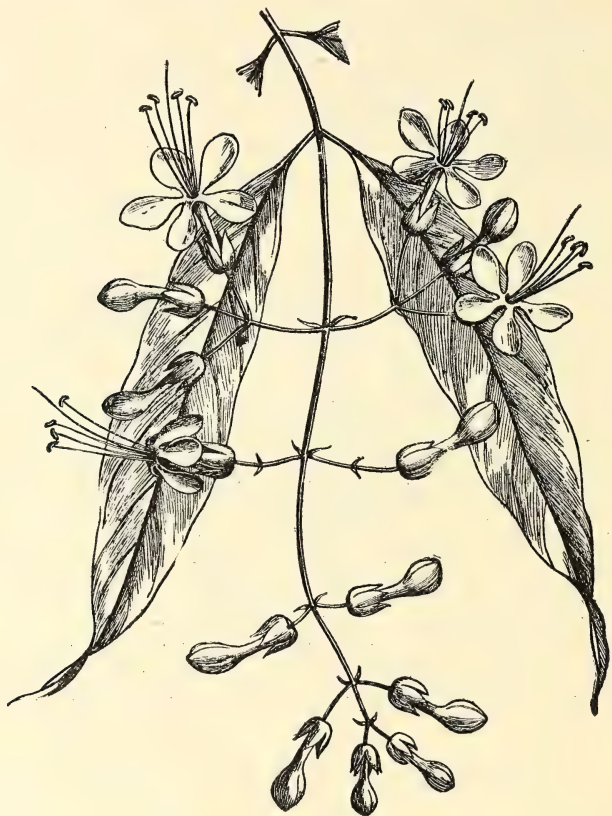


Fig. 7.—*Clerodendron nutans* Wall. ex Don. $\times \frac{1}{2}$.

Gardening.—A small, hardy shrub with opposite, dark-green, elliptic leaves and pure white flowers produced on long drooping racemes. It is suitable for culture in the ground or in pots, especially in moist, protected places. Propagated by cuttings or seed.

***Clerodendron trichotomum* Thunb.**

(The specific epithet refers to the trichotomous arrangement of the flowers).

Description.—A shrub or small tree, sometimes reaching a height of 10 ft. Branches round or the younger quadrangular, soft, glabrous, pubescent or covered with a fulvous, crisped tomentum; bark longitudinally fissured. Leaves opposite, petioled, lower very large and 3-lobed, the upper broadly ovate or orbicular-ovate, 6 in. long by 3 in. broad, rounded or truncate at the base, shortly cuneate at the petiole, long acuminate at the tip, soft and flaccid, sparsely hairy on both surfaces, especially on the nervation, entire on the margin; petiole terete, up to 3 in. long, slender, tomentose,

Calyx .5 in. long, reddish-brown in colour, sparsely hairy; tube obconical, 5-lobed; lobes triangular or ovate, acute, .25 in. long or longer. Corolla white; tube more or less exserted, very slender, up to 1 in. long, slightly curved, 5-lobed; lobes nearly equal .5 in.



Fig. 8.—*Clerodendron trichotomum* Thunb. $\times \frac{1}{2}$.

long, elliptic, obtuse or subacute, horizontally spreading. Stamens 4; filaments long exserted, slender; anthers oblong. Ovary glabrous; style slender; stigma shortly bifid. Fruit 4-lobed; included in the scarcely enlarged calyx.

Flowers.—Rainy season.

Distribution.—A native of Japan, now commonly cultivated in the subtropical parts of the whole world.

Gardening.—A hardy shrub, quite handsome during the rains when it is in flower. It was introduced into England about 1880 and is propagated by seed.

***Clerodendron phlomidis* Linn. f. (*C. phlomoides* Willd.).**

Description.—A scandent bush or small tree. Branches pubescent, whitish-grey. Leaves opposite, readily disarticulating, 1-2 in. long, deltoid-ovate, often broader than long, truncate or subcordate at the base, obtuse or acute at the tip, coarsely crenate-dentate or subentire on the margin, glabrous above, more or less puberulous beneath; petiole .5-1 in. long.

Flowers arranged in small, dichotomous, axillary cymes on a rhachis so as to form a rounded, terminal panicle; bracts small, leafy, lanceolate, acute. Calyx .4 in. long or more, divided about half way down, glabrous, not enlarged in the fruit, 5-lobed; lobes ovate, acutely acuminate, veined. Corolla white or pinkish; tube



Fig. 9.—*Clerodendron phlomidis* Linn. f. $\times \frac{1}{2}$.

.7-1 in. long, slightly pubescent outside, glabrous inside; lobes nearly equal, 5 in number, .3 in. long, elliptic, obtuse veined. Stamens 4; filaments much exserted, slender, slightly pubescent. Ovary glabrous; style slender; stigma bifid. Fruit a drupe, .25 in. long, broadly obovoid in shape, depressed, seated within the persistent calyx-lobes.

Flowers.—November-December and also at other times of the year.

Distribution.—Throughout the drier parts of India from the Punjab and Bengal to South India and Ceylon.

Gardening.—A shrub with white or pinkish, fragrant flowers. It is a common jungle plant and hardly deserves to be grown in a garden. Propagated by seed.

Medicinal uses.—The leaves of this plant are given to cattle for diarrhoea and worms.

THE LARGER DEER OF BRITISH INDIA

BY

R. I. POCK, F.R.S.,

(Zool. Dept., British Museum, Natural History).

PART II.

(With 7 text-figures).

(Continued from Vol. xliii, No. 3 (1942), p. 317).

In the first part of this paper published in the last issue of this Journal, it was stated that the skull of Wallich's Deer (*Cervus wallichii*) therein described was not available for examination. It has since then been found; and, as was surmised, proves to be similar to the skull of the Shou (*Cervus affinis*). With the total and condylobasal lengths of 468 mm. (about $18\frac{3}{4}$ in.) and 441 mm. (about $17\frac{3}{5}$ in.) respectively, it is as large as the largest skull of the Shou recorded and has, moreover, the free edge of the nasal abutting against the facial vacuity very short, only 13 mm. long. The average shortness of this edge was the only character, apart from its general larger size, distinguishing the skull of the Shou from that of the Kashmir *Barasingh* or Hangul (*C. hanglu*). The vertical diameter of the orbit is 54, the length of the vacuity is 70 and the length and height of the gland-pit respectively 45 and 25 mm. These measurements agree on the average with those of the Shou and may be compared with those of the Sambar recorded below. The antlers are decadent with age; but the longer of a pair shed in the Zoological Gardens and found with the skull is about 42 in. over the curves and has a girth above the burr of $10\frac{1}{2}$ in. It is abnormal in carrying near the base of the bezel a supplementary branch 7 in. long.

The three above-mentioned species of Deer belong essentially to a Palearctic group of the family and must be regarded as the descendants of trespassers from that region into Kashmir and the Himalayas. The remaining species of Indian Deer are members of the Oriental fauna.

THE SWAMP-DEER, SCHOMBURGK'S DEER AND THE THAMIN.

The Swamp-Deer, which is restricted to India, and the Thamin or Eld's Deer, which is widely distributed to the east of the Bay of Bengal, are usually assigned by recent authors to *Rucervus*, sometimes given full generic rank, and sometimes subgeneric rank under *Cervus*. But close upon a century ago Gray restricted *Rucervus* to the Swamp-Deer (*duvaucelii*) and to Schomburgk's Deer (*schomburgki*) of Siam and separated from them the Thamin (*eldi*) as *Panolia*. Since I agree with Gray's views that the Swamp-Deer

is generically distinguishable from the Sambar (*Rusa*) and from the Swamp-Deer, I adopt both *Rucervus* and *Panolia*. But since also it appears to me that Schomburgk's Deer has a good claim to generic distinction, I propose to give it a new name.

The three genera may be briefly diagnosed as follows:—

- a. Pedicles of antlers markedly divergent, (Fig. 1, B) the brow tine and bases of the beams widely separated, upper portion of beams not abruptly outcurved, first posterior inner branch of the beam larger, with at least two tines; nasal penetration of the frontals deep and acutely angular.
 - b. Beam of antlers long, longer than the face and than the main terminal tines of its two branches, of which the anterior outer, when fully developed, is the larger; nasals narrower, more compressed, their anterior excision shallow, with short outer points *Rucervus*
 - b.¹ Beam of antlers short, shorter than the face and typically not longer than the main terminal tines of the two branches which are subequal; nasals broader, hardly compressed, their anterior excision deep, with long outer points *Thaocervus*
- a.¹ Pedicles of antlers erect and parallel or nearly so, (Fig. 1, A) brow tines and bases of beams close together, upper portion of beams with strong outward curvature; first posterior inner branch of beam small, typically consisting of a simple tine which may be reduced to one or two spikes; nasal penetration of frontals shallow *Panolia*

Genus *Rucervus* Hodgson.

(The Swamp-Deer).

Rucervus, Hodgson, Ann. Mag. Nat. Hist. (1), I, p. 154 and of most recent authors, misprinted as *Recervus* by Gray in 1847, as *Recurvus* by Jäger and Bessels in 1870 and as *Recervus* by Trouessart in 1898.

Type of the genus;—*Cervus elaphoides* Hodgson (= *duvaucelii* Cuvier)

Distinguished in its external characters from *Cervus* principally by its much longer, bushier tail, larger ears, broader moist area of the rhinarium below the nostrils in front, the absence of the rump patch and by the antlers which have a single brow tine and

the first anterior branch above it, representing the so-called 'trez' tine of *Cervus*, situated at the summit, bearing at least two tines and never smaller and thinner than the branch behind it but typically surpassing it in size. In the British Indian species of *Cervus* there is always a bez tine, often regarded as a duplication of the brow

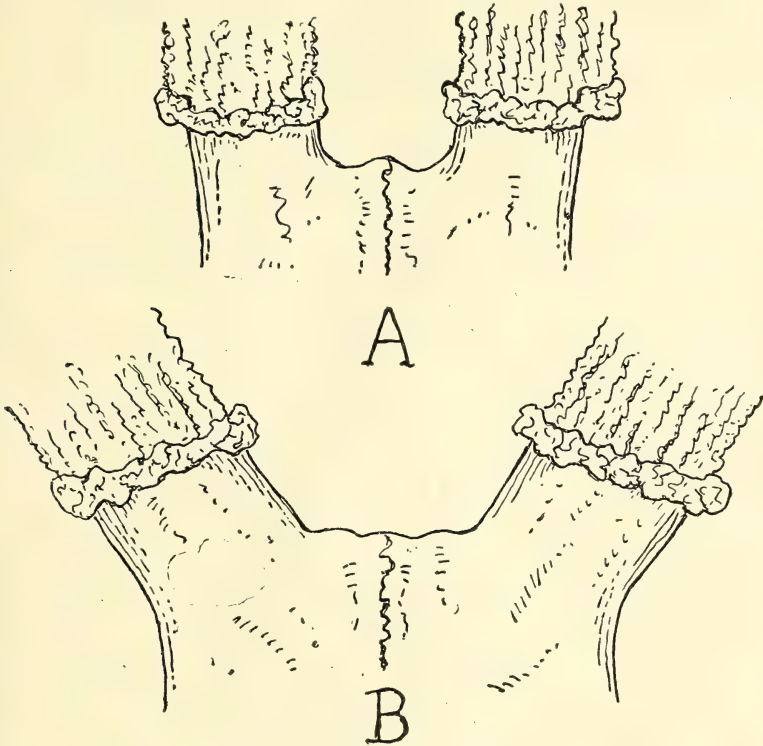


Fig. 1.

A. Erect and parallel pedicles and bases of the antlers of a Thamin (*Panolia*), the brow tine omitted.

B. Divergent pedicles and bases of the antlers of Schomburgk's Deer (*Thaocervus*), the same occurring in *Rucervus*, the brow tine omitted.

tine, but this is a variable feature in the genus, being absent in some races of the European Red Deer (*Cervus elaphus*) and very liable to be suppressed under unfavourable conditions, in others that normally possess it. A more important difference is the small size and simple structure of the first anterior branch, above the brow or bez-tine, namely the 'trez' tine which never, in the adult, constitutes part of the summit of the antler and is always markedly subordinate in size to the first posterior branch which is as thick as the part below the 'trez' tine, constitutes with it the so-called 'beam', is elongated and carries at least two tines, the 'surroyals', forming the summit of the antler.

The skull of *Rucervus* has its facial portion relatively narrower, the upper portion of the orbits less developed, the anterior nares

narrower as compared with their length and the auditory bullae more inflated, wider and higher, so that they project below the level of the adjoining surface of the basioccipital bone, or above it if the skull is inverted; and the female, according to Hodgson, has no supper canine teeth which are present in both sexes of *Cervus*. I have only been able to verify this on a single young adult ♀ skull, one of Hodgson's, since sportsmen naturally avoid shooting hinds.

***Rucervus duvaucelii*, Cuvier.**

Cervus duvaucelii, Cuvier, Ossements Fossiles (3), 4, p. 505, 1825.

For a presumably nearly complete list of bibliographical references: see Lydekker's Cat. Ung. Brit. Mus., 4, pp. 93-94, 1915 where the species is cited as *Cervus (Rucervus) duvaucelii*.

Distribution.—India, north of the Ganges from Kumaun to Assam and south of the Ganges, principally in the Central Provinces.

The characters of this species are contained in the generic diagnosis given above and in the descriptions of the two subspecies recorded below.

In his interesting volume *Wild Animals in Central India*, 1927, Dunbar Brander, who was acquainted with this deer both in the United Provinces north of the Ganges and in the Central Provinces south of that river, pointed out that its habitat differs in the two districts. In the northern area it is essentially a swamp-deer, well deserving its name, whereas in the southern area that name is quite inappropriate, since the species is essentially a grazer in the open plains, showing no liking for wet ground. He found, moreover,—as indeed might have been expected—that the feet of the species in the two districts are adapted to their respective soils and differ structurally in consequence. He suggested the possibility of the existence of one or two additional differences between them and wondered there were not more striking distinctions, considering the long geographical isolation of the two.

Since from the measurement of skulls in the British Museum I find evidence that those of the northern Swamp-Deer are larger than those of the southern, it seems clear that there are two local races of the species: and since all the synonyms of *duvaucelii* appear to have been given to the northern type, the southern requires a new name. I propose to dedicate it to Mr. Dunbar Brander in acknowledgment of his detection of the principal difference between the two races.

***Rucervus duvaucelii duvaucelii*, Cuvier.**

(Duvaucel's Swamp Deer).

Cervus duvaucelii, Cuvier, Foss. Foss., ed. 3, IV, p. 505, 1825; and of most subsequent authors as *Cervus* or *Rucervus* (in part).

Cervus hahrainja, Hodgson, Proc. Zool. Soc. 1834, p. 99.

Cervus elaphoides, Hodgson, Journ. As. Soc. Beng., 4, p. 648, 1835, and Ann. Mag. Nat. Hist. (1), 1, p. 154, 1838 (*Rucervus*).

Cervus dimorphe, Hodgson, Journ., As. Soc. Beng., 12, p. 897, 1843.

Cervus eucladoceros, Falconer, Pal. Mem., 1, p. 587, 1868.

Locality of the type of *duvaucelii*, based on sketches of antlers sent by Duvaucel, not recorded, but no doubt N. India; of *bahrainja*, Népal; of *elaphoides*, substituted for *bahrainja*, Nepal; of *dimorphe*, the Sal Forests of the Morung, Nepal; of *eucladoceros*, Hardwar.

Distribution.—North of the Ganges, at least from Kumaun (Naini Tal), the Nepal Terai, and the United Provinces to Assam, and the Sunderbans.

Skull larger than in the Southern race, its total length up to almost 16 in. and its condylobasal length to $15\frac{1}{2}$ in. Feet with the hoofs 'spongy', longer, especially the heels, and with a tendency to splay. Possibly, on the average the colour is lighter.

No skin of this race is available at the moment for description; but I suspect the specimen described in 1871 by P. L. Sclater (Trans. Zool. Soc., 7, p. 347) belonged to it. The colour in the winter, he said, is dullish brown, in the summer brilliant golden yellow glossed in the ♂ with purplish black in front. But on pl. 36 a specimen, alleged to be in summer coat, is decidedly brown, the body being everywhere overcast with black speckling, with the lips, chin, interramal area, the belly and the back of the thighs buffy. Another specimen in the background is redder, it is true; but it may be noted that both are carrying cleaned antlers suggestive of winter. No spots in the summer coat are mentioned in the text or shown in the figures.

There are seven nearly complete adult male skulls assigned to this race in the British Museum; two from Nepal (Hodgson, Nos. 694 *a* and *b*), excluding the type of *dimorphe* which is young; two from Kheri, Oudh (Hume, Nos. 12. 10. 31. 6 and 91.8.7.8); two from Gowhati, Assam (Hume, Nos. 12.10.31.5 and 91.8.7.9) and one merely labelled Assam (Biddulph, No. 23.10.5.54). The last is the smallest, with tine total and condylobasal lengths 380 and 365 respectively. The largest is one of Hodgson's (No. 694 *a*) with those dimensions 397 and 384 mm. respectively. But one from Gowhati, with the occipital crest and condyles missing, had, I estimate, a total length of 400 mm., certainly not less than in Hodgson's skull. The average total length of these seven skulls is as nearly as may be $15\frac{3}{5}$ in. and the condylobasal length of four of them, the condyle being missing in the other three, is $14\frac{4}{5}$ in. A third skull from Kheri, Oudh (Burke, No. 27. 2. 14. 113) has the muzzle smashed, but its occipito-nasal length is 317 mm., the same as in one of the skulls from Nepal and one from Gowhati; showing that it was average for the race.

The nasals, apart from being shorter, do not differ appreciably from those of the *Cervus* and are equally variable in width individually. On the average, however, they penetrate between the frontals a little more deeply, the angle they form being always acute and surpassing the level of the ends of the vacuities. The free edge in contact with the vacuity is very variable in length and shape, being long or short, straight, convex or angular. It is longest

in three Nepalese skulls, 38 mm. in 694 *a*, 31 mm. in 694 *b* and 30 mm. in the young type of *dimorphe*; in two from Oudh (Burke) it is 29 and 21 mm.; in the small skull from Assam (Biddulph) it is 25 mm. and in the large skull from Gowhati (Hume) it is only 21 mm. The vacuity itself, as stated under the generic heading, is short as compared with *Cervus*, its length being on the average a trifle less than the vertical diameter of the orbit, but its width is greater in proportion to its length.

According to Dunbar Brander the great majority of the deer of this race he saw in the United Provinces 'were standing in water in long grass and they seemed to spend their whole time in localities of this nature, only emerging at dusk to wade up to their bellies in deeper water to graze off water weeds'.

***Rucervus duvaucelii branderi* subsp. nov.**

(Brander's Swamp-deer).

The Swamp-Deer, Dunbar Brander, Wild Animals in Central India, pp. 193-194, 1927.

Locality of the type:—Mandla, Central Provinces.

Distribution:—South of the Ganges in the Central Provinces and perhaps Orissa.

Distinguished from the typical form by its smaller size, especially indicated by the skull, and according to Dunbar Brander, by the hoof being 'hard and well knit like that of an animal accustomed to gallop on hard ground'. He also states that the colour is often much darker and that the antlers are rougher and not so white as in typical *duvaucelii* from the Terai. This impression regarding the antlers is not, however, substantiated by specimens in the British Museum. In both races the antlers are typically streaked brown and yellowish, brown predominating. But one unlocalised skull (Earl of Derby) of the typical race has antlers like ivory; and in a young skull from Baraitch they are smooth and yellowish.

The following description is taken from Brander's account. The necks of the stags are maned. The ordinary colour (in winter) is brown above, often with a darker dorsal line, but without spots; in 'master stags' the tint may be so dark as to appear almost black at a distance. Females are lighter. As the hot weather advances stags become reddish brown, the does yellowish brown, and the coat is spotted; the spots are arranged as in the Chital but are indistinct, their colour being merely somewhat lighter than the ground colour and they are sometimes only visible when viewed at an angle. They usually appear after the horns are shed and are consequently seldom seen by sportsmen. The spots in the newly-born fawn are much more distinct, almost whitish.

A good average stag measures 7 ft. 4½ in. from nose-tip to tail-tip and stands 3 ft. 11 in. at the withers. The weight of such a stag was 376 lbs. An extreme weight of 420 lbs is contrasted by Brander with Blanford's record of two stags of typical *duvaucelii* from Cooch Behar which weighed 460 lbs. and 570 lbs. respectively. This is another item of evidence of the smaller size of stags from the Central Provinces.

The only available skin is that of a mounted specimen from the Central Provinces (No. 5.11.30.1). Apart from its antlers it differs from a Sambar, which stands alongside it, in being much paler, the general colour being reddish or ochreous brown, a little paler below and on the legs; the head is dark grey with no reddish tint and the backs of the ears are the same tint as the neck, with the whitish area on the lower part less sharply defined than in the Sambar and there is no fuscous patch on the front or inner surface of the ear. There is also more white on the upper lip and the fuscous patch on the corner of the mouth extends only up to the side of the rhinarium, not over the summit of the muzzle, but below it reaches the middle line of the jaw behind the white chin. Like the under side of the tail, the inner surfaces of the thighs are white and this tint is sharply contrasted with that of the backs of the thighs, not blending with it as in the Sambar.

There are three adult ♂ skulls in the British Museum. One from Mandla C.P. (Parsons, No. 30.4.24.7), although the smallest of the three, has been selected as the type of *R.d. branderi* because it has a special locality. It is a 'twelve pointer', having five times at the summit of each antler. Its total and condylobasal length are respectively 360 and 350 mm. The other two skulls (Parsons, No. 30.4.24.11 and Nichols, No. 34.11.12.58) are merely labelled Central Provinces. Their total and condylobasal lengths are respectively 366, 351 and 372, 357 mm. The averages of these dimensions in English inches are as nearly as may be $14 \frac{3}{5}$ and 14, just about 1 inch shorter than the corresponding dimensions in the skulls of the typical northern race. The smallest skull of the latter is longer in both dimensions than the largest recorded skull of *R.d. branderi*.

In the three skulls of *R. d. branderi* the nasal contact with the vacuity is short, ranging from 15 mm. in the type to 23 mm. in the other skull collected by Parsons. In both of these it forms an angular projection; but in Nichols' skull it forms a rounded bulge and is 16 mm. The contact is relatively smaller on the average than in the typical form; but the number of skulls is too small to justify any conclusion on that point.

About the habitat of this race Dunbar Brander says:—

'In the Central Provinces the species shows no special addiction to water. Its requirements are large grassy plains or maidans on which it can graze. It lives on or along the edges of these plains, only penetrating a short distance into the jungle-clad hills'.

Thaocervus nov.

Distinguished from *Rucervus* by the presence of a mane of hair, 2 in. long, extending down the front of the fore-leg below the knee (Brooke); also by some skull-characters and some specialised features in the antlers making them unlike those of any other species of deer. In the skull the nasals are flatter and less compressed; their anterior ends are much more deeply excised, the external processes being exceptionally long, their tips projecting a long way in front of the small, spine-like, internal processes; posteriorly they penetrate more deeply between the frontals and are here narrower

and more pointed; the muzzle is broader, the width across the premaxillae above the canines surpassing by about $\frac{1}{4}$ of an inch (6 mm.) that dimension in the largest measured skull of *Rucervus*; and the posterior end of the premaxilla is separated from the nasal by a narrow process from the maxilla; the gland-pit is shallower and the vacuity smaller. Further particulars about the skull are entered under the specific description. The peculiarities of the antlers are well known and consist essentially in the extreme shortness of the beam, which is shorter than the facial portion of the skull, and the equally extreme length of the principal tines of the two branches into which the beam divides, these tines being typically longer than the beam. In *Rucervus* the beam is long, longer than the face, and the terminal tines of its two branches are comparatively short, much shorter than the beam.

Type of the genus:—*Rucervus schomburgki*.

***Thaocervus schomburgki*, Blyth.**

(Schomburgk's Deer).

Cervus or *Rucervus schomburgki*, Blyth, Proc. Zool. Soc. 1863, p. 155 and 1867, p. 835; Brooke, Proc. Zool. Soc. 1876, p. 306; Lydekker, Cat. Ung. Brit. Mus., 4, p. 97, 1915, where other bibliographical references may be found.

Locality of the type (antlers) believed to be Siam.

Distribution:—N. Siam and, it has been alleged, Yunnan and Laos; but considered to be now extinct.

According to Brooke the winter coat of an adult stag from Siam, exhibited in the Paris Museum, was rather long and coarse. The general colour was uniform brown, darkest on the nose and the upper side of the tail, lightest on the cheeks, the lower parts of the sides and haunches; a decidedly reddish tinge on the limbs, occiput and upper lip, the lower lip, belly and under side of the tail being whitish. Brooke also described the presence of the 'mane' of long hair down the front of the fore-leg below the knee. This feature has been entered under the generic diagnosis because in all the other species of deer known to me the limbs are covered with uniformly short sleek hair. The height was 41 in.; the tail without the hair was 4 in. long and the length and breadth of the ear were respectively $6\frac{1}{2}$ and $3\frac{3}{4}$ in. The dimensions of a Swamp-Deer entered by Brooke for comparison were:—height 43 in., tail 5 in. and ear 7 and $3\frac{1}{2}$ in., the ear being longer but narrower. These measurements taken from mounted specimens are not very convincing. They are entered here because it is not likely that any other measurements of Schomburgk's Deer will be recorded. If, as stated, the ear is broader in the latter, it may indicate a more forest or jungle habitat than is affected by the Swamp-Deer; but as regards size, the skull described below does not bear out the conclusion that Schomburgk's Deer is a smaller species.

The only available skull in the British Museum (Rowland Ward No. 8.3.17.5) was figured, but not described by Lydekker. With a total length of 395 mm. (15 $\frac{4}{5}$ in.) it is a few mm. shorter than

the longest skull of *Rucervus duvaucelii*, but exceeds the average length in that species. The condylobasal length is not available; but in its other dimensions, both in length and breadth, it is for

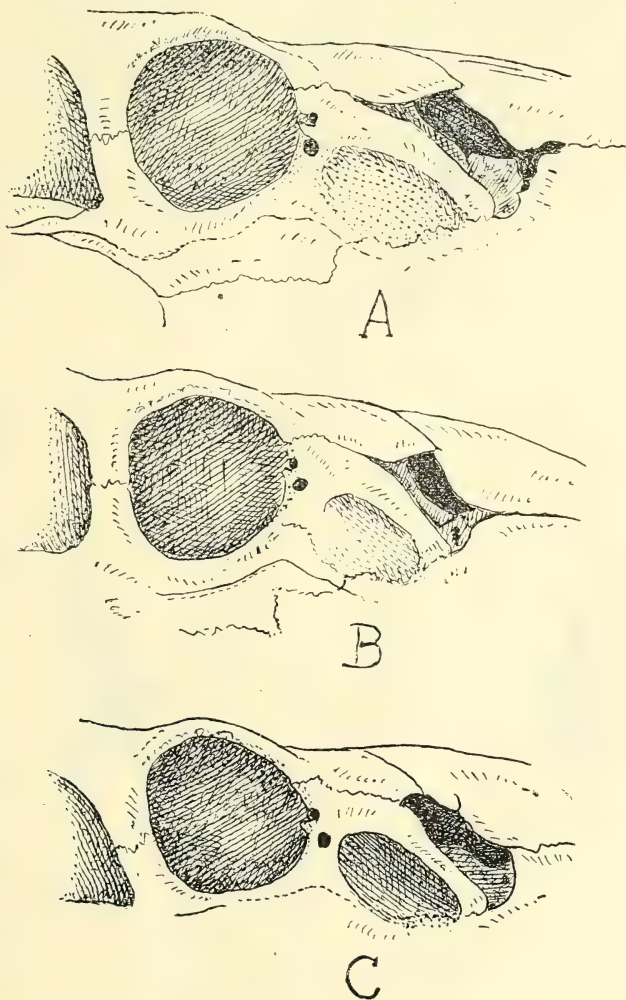


Fig. 2.

A. Side view of orbit, vacuity and gland-pit of Swamp-Deer (*Rucervus duvaucelii duvaucelii*) labelled Barainga, native name (Earl of Derby).

B. The same of Schomburgk's Deer (*Thaocervus schomburgki*) with vacuity and gland-pit smaller than in A.

C. The same of Thamin (*Panolia eldi thamin*) from Pegu (Bruce) showing the much deeper gland-pit than in A and B.

the most part a little bigger than the average of *R. duvaucelii*. The main difference between the skulls of the two, described above under the generic heading, may be amplified by actual figures, the average dimensions in the case of *R. duvaucelii* being taken from 16 skulls.

The vertical height of the orbit in *R. duvaucelii* ranges from 43 to 49 mm., the average being 46. In *Th. schomburgki* it is

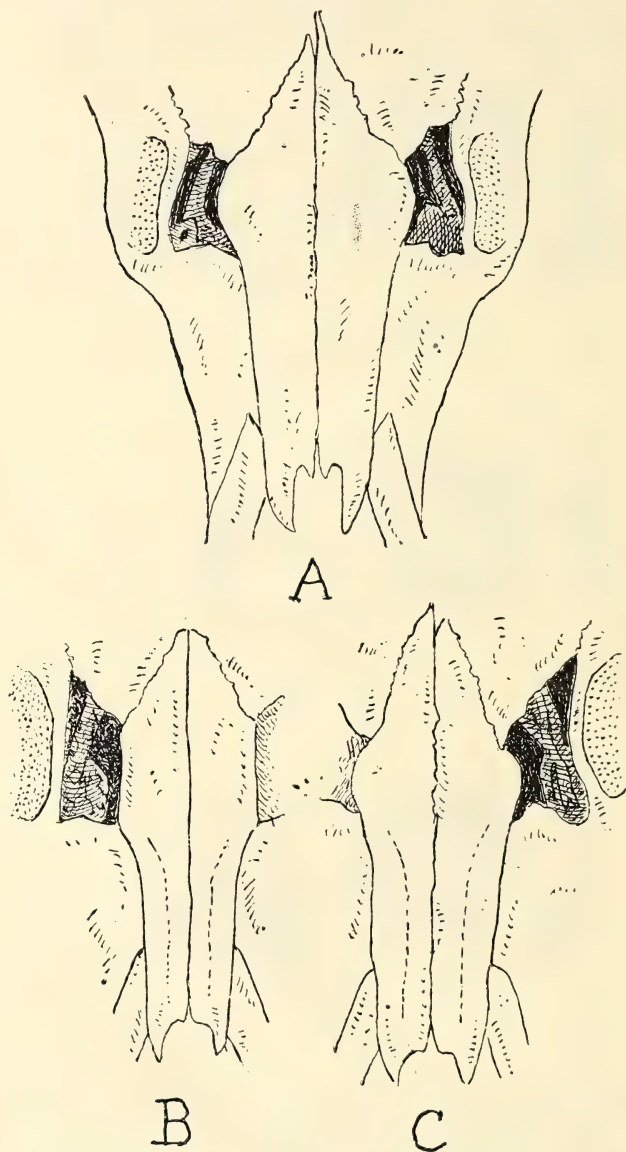


Fig. 3.

A. Nasals and adjoining parts of the skull of Schomburgk's Deer (*Thaocervus schomburgki*) showing especially the breadth of the nasals between the vacuities and the depth of the anterior excision. The gland-pit dotted.

B. and C. Nasals, vacuity and inner part of gland-pit (dotted) of Swamp-Deer (*Rucervus duvaucelii duvaucelii*) from Kheri, Oudh (Hume) and of *R. d. branderi* from the Central Provinces (Nichols), the difference being individual, not racial. For comparison with A.

about the same, namely 45. The vacuity in *R. duvaucelii* varies in length from 39 to 56, the average being 47, and its width or height, measured from the middle of the free edge of the nasal, from 18 to 26, the average being 22; in *Th. schomburgki* its length and width are respectively 36 and 17, actually a little less in both dimensions than the smallest recorded for *R. duvaucelii* and considerably less than the average. The length of the gland-pit in *R. duvaucelii* varies from 38 to 47, the average being just over 40; in *Th. schomburgki* its length is 36, a little less than the smallest and still shorter than the average in *R. duvaucelii*; it is also shallower (Fig. 2).

The free edge of the nasal where it borders the vacuity is extremely variable in *R. duvaucelii*, from 15 to 38 mm. long, the average being 24; in *Th. schomburgki* it is practically the same as that average, namely 23. The length of the fronto-nasal suture indicating the degree of penetration of the nasals between the frontals ranges in *R. duvaucelii* from 28 to 43, the average being 37; in *Th. schomburgki* it is 48, a few mm. longer than the longest recorded in *R. duvaucelii* and 11 mm. over the average of that species. These facts bear out the statements in the generic definition of *Thaocervus* that the vacuity and gland-pit are smaller and the penetration of the nasals is deeper than in *Rucervus* (Fig. 3).

A considerable number of antlers is preserved in the British Museum; and Blyth in 1867 described and figured many showing a good deal of individual variation. The main differences between them and the antlers of *Rucervus duvaucelii* are cited above and I have seen no intermediates between them in their principal features. A minor average difference, in my experience, is the apparently invariably rectangular junction between the brow tine and the beam in *Th. schomburgki*. Occasionally the junction is rectangular in *Rucervus duvaucelii*; but as a rule it is obtusely angular, the angle being in rare cases so obtuse that the brow tine and the beam are almost in the same line where they join. Blyth (*op. cit.* p. 837, fig. 5) figured one such antler and pointed out its resemblance in this respect to the antlers of the Thamin (*Panolia eldi*); but the antlers of a Swamp-Deer figured by Lydekker (*op. cit.* p. 95, fig. 18) as of this nature are manifestly not so, the angle between the brow tine and the beam being obviously and tolerably normally obtuse.

Panolia Gray.

Panolia, Gray, List. Mamm. Brit. Mus., p. 180, 1843 and Cat. Ung. Mamm., p. 202, 1852; Blyth, Proc. Zool. Soc. 1867, p. 835 and of most subsequent authors, usually as a subgenus of *Cervus* or *Rucervus*.

Type of the genus:—*acuticornis* Gray (= *eldi*).

Essentially distinguished by the pedicles of the antlers being narrowly separated and erect or very nearly so, their inner edges sometimes slightly divergent or convergent, so that the bases of the brow tine and beam are close together, in some cases nearly in contact and subparallel, and the external edge of the pedicle

and of the postorbital area in front of it has its curvature less strongly concave. In these features the genus differs from all the other genera of Cervidae at least of the Old World.

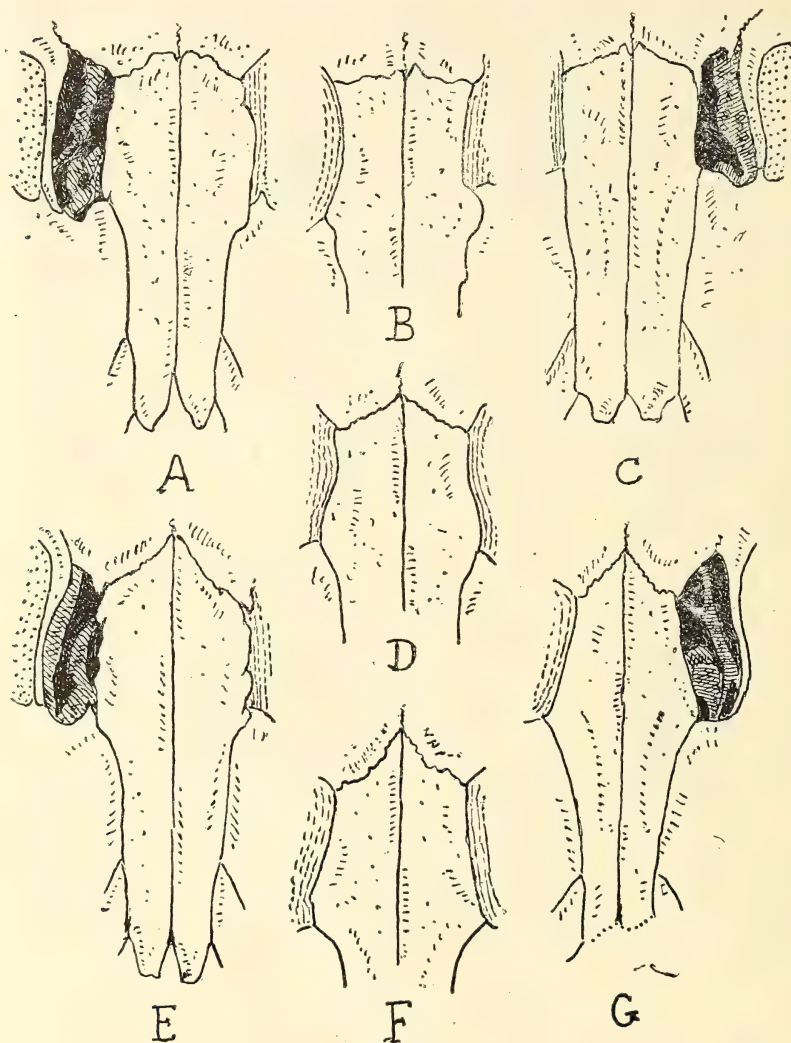


Fig. 4.

Nasal bones, vacuity and inner part of gland-pit (dotted) of Thamin (*Panolia*) showing individual variation, frequent asymmetry and especially the shallow penetration of the frontals by the nasals and their long free edge bordering the vacuity.

A. *P. eldi*, type of *cornipes*, from Manipur.

B. *P. eldi thamin*, type of *brucei*, from the Ruby Mines, Upper Burma.

C. *P. eldi thamin*, topotype of *brucei*, from the Ruby Mines.

D. *P. eldi thamin* from Tenasserim.

E. and F. *P. eldi thamin* from Pegu.

G. *P. eldi thamin* from Monzwa, Upper Burma, the tips fractured.

From its nearest ally, *Rucervus*, which it closely resembles in the

inflation of the auditory bullae, it further differs in the following skull-characters: (1) The very variable nasals are more truncated posteriorly and penetrate less deeply between the frontals, the naso-frontal suture ranging in length in thirteen skulls from 17 to 30 mm., the average being 23. (2) The free edge of the nasals bordering the vacuity is on the average longer, the variation being from 22 to 42 and the average 31. (3) The vacuity is about the same length, ranging from 41 to 54, with the average $47\frac{1}{2}$; but is on the average considerably narrower, its width ranging from 11 to 20, with the average 16. (4) The gland-pit is deeper, with more sharply defined edges, its average length of 40 being the same as in *Rucervus*, although the skull is smaller, and it more nearly approaches in length the vertical diameter of the orbit which is on the average 43, actually smaller than in *Rucervus* but relatively about the same size (Fig. 4). The corresponding dimensions of these parts of the skull in *Rucervus* are entered under the description of *Thaocervus*.

The total length in twelve skulls ranges from 320 to 346 mm., the average being 333 ($13\frac{1}{4}$ in.) and the condylobasal length in eight varies from 301 to 325, the average being 312 ($12\frac{1}{2}$ in.), the two being respectively about $1\frac{1}{2}$ in. shorter than those dimensions in the smaller race of *R. duvaucelii*:

The antlers, apart from their basal proximity mentioned above, are characteristic, showing no likeness to those of *Thaocervus* and differing typically from the antlers of *Rucervus* in having the junction of the brow tine and the beam in a straight line or forming a much more obtusely open angle; and to compensate for their basal proximity the beams have a much more strongly pronounced backward and outward curvature. Also the first branch of the beam is less developed, usually undivided and not uncommonly reduced to a small snag; the brow tine often carries accessory upright snags, sometimes as much as eleven inches long, and the tip of the antler is very variable, usually simply bifid but sometimes palmate with many small snags.

In 1910 (Pro. Zool. Soc., 1910, pp. 244-245) I described and figured the fore and hind feet of a Thamin belonging to the typical Burmese race and pointed out that the integument between the heels of the main hoofs is wider than in other typical Deer, including *Rucervus*, giving greater distensibility to the hoofs and that the skin immediately surrounding the false hoofs is naked, not hairy as, for example, in the foot of a Swamp-Deer described at the same time. But in view of Dunbar Brander's account of the difference in the feet between the two races of Swamp-Deer and Lydekker's description of the feet in a Thamin from Manipur, referred to below, it is evident that the feet of additional specimens of both species must be examined before any general conclusion regarding these extremities can be drawn.

***Panolia eldi*, McClelland.**

(The Thamin or Eld's Deer)

Cervus eldi, McClelland, Calc. Journ. Nat. Hist., 2, p. 417, 1842.

Locality of the type:—Manipur.

Distribution.—Manipur, Burma as far south as Tenasserim and probably at least the northern parts of the Malay Peninsula; Siam, Annam and Hainan.

The main characters of the skull and antlers of this species are given above under the generic heading.

Only one skin is at present available for description. This is a mounted specimen in the British Museum, the type of *Rucervus thamin* Thomas, from Pegu. It has longish hairs on the neck like the mounted example of *Rucervus duvaucelii branderi* referred to above; but it differs from that Swamp-Deer in having the general colour fawn, lighter and less red, the whole of the back of the ear like the back, with no white near its lower rim but a patch of that tint at the junction of the ear and the neck externally; the anterior part of the muzzle is lighter than the rest of the face, apart from a dusky patch on the corner of the mouth, but this patch does not spread upwards to the nose or on to the lower jaw to emphasize the whiteness of the upper lip and chin as it does in the Swamp-Deer.

An example of the same race from British Burma was described and illustrated in colour by P. L. Sclater (Trans. Zool. Soc., 7, 1872). It showed marked seasonal change in colour which in the autumn (late summer) coat was bright ochreous red, with a few faint spots on the hind flank and thigh, the legs below the knees and hocks duller and paler, the edge of the upper lip, chin, throat, breast, belly and inner side of the thighs white and the upper side of the tail brown (pl. 37). In winter the colour was uniformly dark brown all over the upper side, except the upper lip, chin, interramal area a patch at the top of the throat which, like the belly, were buffy. No trace of the spots present in the summer coat were shown: but the neck, which was smooth in summer, was maned (pl. 38).

In 1918 Thomas published a revision of the different kinds of Thamin, which he referred to the genus *Rucervus* (*Journ. Bomb. Nat. Hist. Soc.*, 25, p. 363). The chief value of this paper lies in its correction of the nomenclature adopted by Lydekker in 1915. I accept Thomas's conclusions on these points and it is needless to repeat what he said. It is needless also to repeat the synonymies he established. But in one or two particulars I find myself unable to agree with him. The first is his opinion that the Thamin are referable to three distinct species, *eldi* from Manipur, *thamin* from Burma and *platyceros* from Siam and Hainan. The second is his claim that there are two local races of Thamin in Burma. In my opinion there is only one species of this deer and only one race of it in Burma. My reasons for dissent on these points are given below under their appropriate headings.

***Panolia eldi eldi*, McClelland.**

Cervus eldi McClelland, Calc. Journ. Nat. Hist., 2, p. 417, 1842.

Cervus eldi cornipes, Lydekker, Nature, 54, p. 257, 1901.

Rucervus eldi, Thomas, Journ. Bomb. Nat. Hist. Soc., 25, p. 363, 1918 with full synonymy.

Locality of the type:—Manipur.

Distribution:—Manipur.

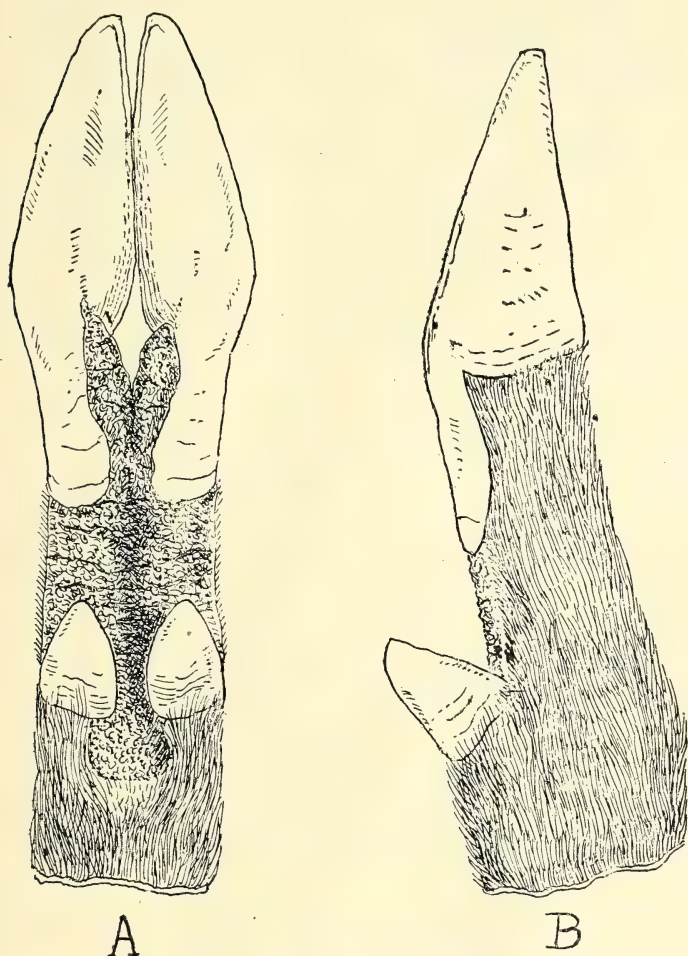


Fig. 5.

A. Lower surface of hind foot of *P. eldi eldi*, the type of *cornipes* from the marshes of Manipur (Cumberland).

B. Side view of the same foot.

Distinguished on the evidence of a single specimen from the other races of Thamin by the structural adaptation at least of the hind feet for progression on marshy land. The hoofs and pasterns are longer and the horny tissue of the heels is continued backwards on each side of the pastern half way to the false hoofs, the skin between and behind these sharply defined horny strands and over the whole of the rest of the pastern up to and between the false hoofs thick and coarsely coriaceous, irregularly grooved

transversely and provided only with a few very short, erect, scattered hairs, not strictly speaking naked as stated by Lydekker when he described this Thamin of the Manipur swamps as *cornipes* (Fig. 5).

I provisionally accept Thomas's restriction of the name *eldi* to the Manipurese Thamin with feet as above described; but, it is to be remembered that since the feet of the actual types of *eldi*, collected by Eld, and of one named *frontalis* collected by Guthrie, are unknown, the assumption that they were fashioned as in the type of *cornipes* is a mere inference. Since the whole of Manipur is not swampy, one or both of the first mentioned types may have inhabited comparatively dry plains. In that case their feet, it may be supposed, resembled those of the typical Burmese race as described in my paper in 1910. It seems to me to be probable, moreover, that in Manipur there exist, or existed, Thamin frequenting less marshy districts than those in which the type of *cornipes* was shot and having feet intermediate in structure between the two extremes above mentioned.

There is no evidence of any difference between the skulls of Manipurese and Burmese Thamin. The antlers of those from Manipur vary considerably in characters claimed by Thomas to be of sub-specific value. In a fine pair, without skull. (Hume No. 12. 10.31.8) they are coarsely corrugated throughout; the left is 32 in. long; the beams of the two diverge at a decidedly obtuse angle and the brow tine is uptilted at an obtuse angle to the beam; the right brow tine has a large accessory branch near its base $11\frac{1}{4}$ in. long, and a shorter one, $2\frac{3}{4}$ in. long, near its middle; on the left brow tine there is a basal accessory branch $7\frac{1}{2}$ in. long; on the beams the first tines on the inner side are greatly reduced, one more than the other, so as to form practically functionless vestiges; the ends of the antlers are cylindrical and very unequally bifid on the two sides. In the skull of the type of *cornipes* (Cumberland, No. 1.7.13.1), which has total and condylobasal lengths of 328 and 304 mm. respectively, and is apparently fully adult, the antlers are very small, only $16\frac{1}{2}$ in. long, and smooth throughout except quite at the base; their beams diverge at a right angle and end in a bifid tip.

***Panolia eldi thamin*, Thomas.**

Rucervus thamin, Thomas, Journ. Bomb. Nat. Hist. Soc., 25, p. 364, 1918.

Rucervus thamin brucei, Thomas, op. cit., p. 366.

Locality of the type of *thamin* Pegu; of *brucei* Thimbaung Gwin plain, Ruby Mines.

Distribution:—Upper and Lower Burma including Tenasserim, also Siam and probably the Malay Peninsula.

Distinguished from typical *eldi*, on the evidence supplied by the type of *cornipes*, by the feet being shorter and more compact; with the skin on the lower surface of the pastern normally soft, thin and closely covered with hair like the upper side and with no extension of the horny heels.

In his description of the skull of *brucei* from the Ruby Mines, Upper Burma (Bruce, No. 17.7.8.17-18) Thomas claimed that it differs from typical *thamin* from Pegu, Lower Burma, in having the ridge forming the upper edge of the gland-pit poorly developed and rounded as compared with the sharp-edged ridge in other Burmese Thamin; also that the brow tines are more bent up, forming with the beams an angle of 130 degrees or 140 degrees, instead

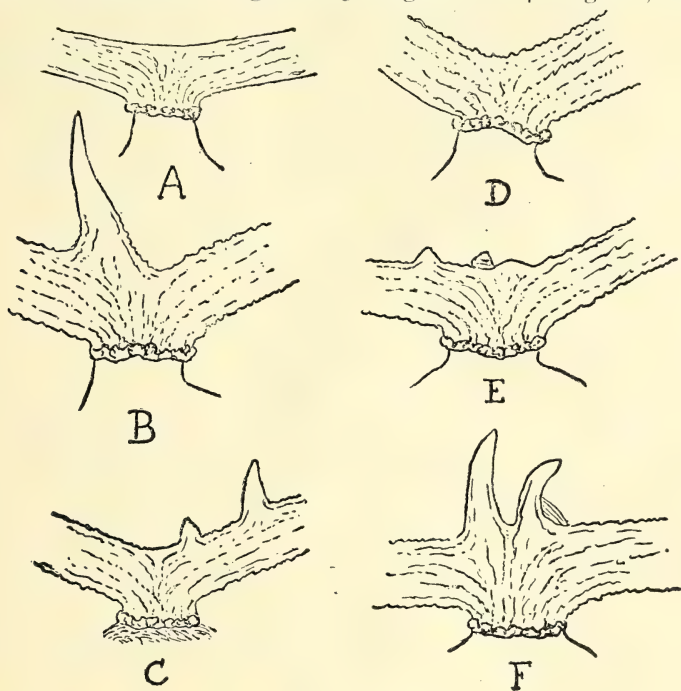


Fig. 6.

Outer side of base of left antler of some Thamin (*Panolia*) showing differences in the alignment of the brow tine, to the left, and the beam, to the right.

A. *Panolia eldi eldi*, type of *cornipes*, from Manipur (Cumberland), the two branches approximately in line.

B. *Panolia eldi eldi* from Manipur (Hume), an older antler, with the branches divergent at an obtuse angle.

C. *Panolia eldi thamin*, type from Pegu, with the junction also obtusely angular.

D. *Panolia eldi thamin*, type of *brucei* from the Ruby Mines, Upper Burma, with the angle only slightly less obtuse than in C.

E. *Panolia eldi thamin* from Magwe, Upper Burma (Stockley) with the angle more widely obtuse than in D. and C.

F. *Panolia eldi platyceros* from Siam (Schomburgh) with the branches in a straight line.

of being nearly in a straight line with the beams. The main portion of the beams, moreover is more inclined backwards, only slightly divergent, the angle formed by tangents from their median portions forming an angle of from 70 to 75 degrees. This diagnosis seems to have been taken from the type of *brucei* only. At all events in a second skull collected by Bruce at the Ruby Mines the edge of the gland-pit is not quite so rounded on one side as in the type

and although it is broken on the other side, the part that remains is quite sharp. Both these skulls, judging from their exceedingly worn teeth, are old and I believe the roundness of the ridge in question to be an age character.

As for the antlers, the features relied upon by Thomas are too variable individually to deserve the systematic importance he attached to them. The brow tine in Bruce's second specimen from the Ruby Mines is less uptilted than in the type of *brucei* and in the latter the uptilting is only a trifle greater than in the type of *thamin* from Pegu and in another skull from the same locality collected by Bruce, in both of which the brow tine and the beam are by no means in a straight tine. The variations in the divergence of the beams are even greater. In the type of *brucei* the beams are abnormally asymmetrical, the left being much straighter and less outwardly divergent than the right; and in the second skull from the Ruby Mines both antlers are strongly outcurved their tangents meeting at an angle of almost 90 degrees. Usually in the Thamin, as Thomas stated, that angle is considerably greater than a right angle; but the view he apparently entertained that in Upper Burmese specimens the brow tine is more uptilted and the angle between the main beams more acute and much smaller than in Lower Burmese specimens is demonstrably unsound.

In both the north and the south of Burma the brow-tine and the beam may diverge at a definite obtuse angle or be in almost if not quite the same straight line; and in Upper Burma the main beams may diverge at a widely obtuse angle as in an example from Magwe District (Stockley) and one from Monzwa District (Gilbert). On the other hand in a second specimen from Monzwa the angle of divergence is acute, about the same as in the type of *brucei*. Like the two examples from the Ruby Mines, the two from Monzwa show that the degree of divergence of the beams may vary greatly in the same locality (Fig. 6).

This question has been dealt with at some length because Thomas's verdict that there are two geographical races of Thamin in Burma has been quoted by E. H. Peacock in 'A Game Book for Burma etc.' 1933 and by H. C. Smith in his 'Wild Animals of Burma' p. 41, 1935.

***Panolia eldi platyceros*, Gray.**

Panolia platyceros, Gray, List. Mamm. Brit. Mus., p. 181, 1843; and of subsequent authors including Thomas, Journ. Bomb. Nat. Hist. Soc., 25, p. 364, 1918 where other references and full synonymy are given under the specific name *Rucervus platyceros*.

Locality of the type:—Siam.

Distribution:—Siam, Annam, Hainan.

Distinguished apparently from the typical Burmese race, *thamin*, as figured by Sclater, by the absence of marked seasonal change in the colour which, according to Lydekker, on unstated authority, is reddish throughout the year, with spots along each side of the spinal area and in some cases also on the sides of the body. The

most commonly cited difference however, lies in the antlers which seem to be always palmated, somewhat as in the Fallow Deer (*Dama*); that is to say they are expanded and more or less flattened at the end, with the posterior edge of this area beset with numerous small points.

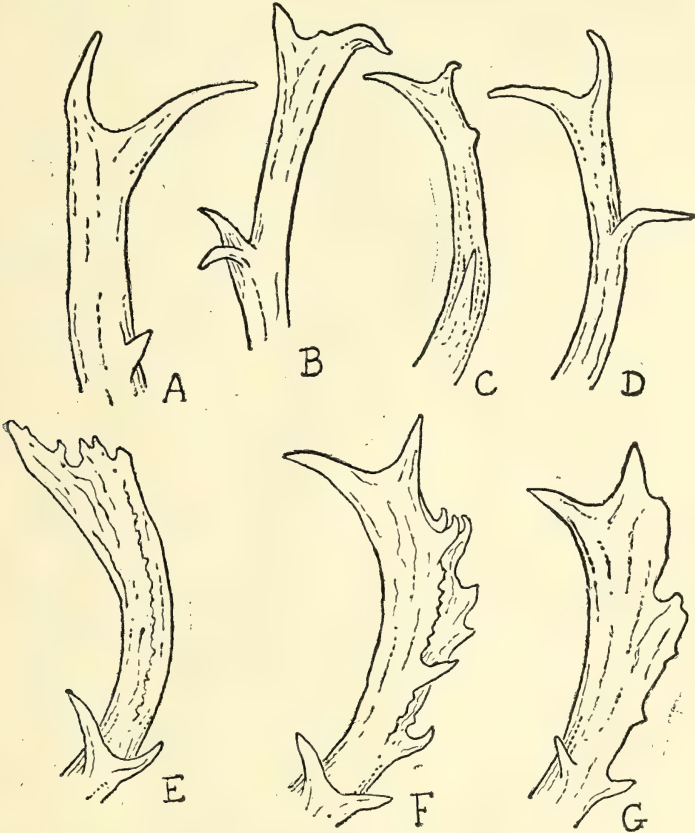


Fig. 7.

Upper part of antlers, from the inner side, of various specimens of the *Thamin* (*Panolia*) showing individual variation and especially the intergradation between the ordinary and the palmate types.

A. Left antler of *P. eldi eldi* from Manipur (Hume).

B. Left antler of *P. eldi thamin*, the type of *brucei* from the Ruby Mines (Bruce).

C. Right antler of *P. eldi thamin*, toptype of *brucei* from the Ruby Mines (Bruce).

D. Right antler of *P. eldi thamin* from Pegu (Bruce).

E. Right antler of *P. eldi thamin*, the type of *brucei* for comparison with B. and to show the semipalmate type leading to F and G.

F. Right antler of *P. eldi platyceros* from Siam (Schomburgk).

G. Right antler of *P. eldi platyceros* from Nhatrang Annam (Vassall).

Reverting to the antlers of the two skulls of *thamin* from the Ruby Mines some additional differences between them have an important bearing on the status of *platyceros*. In the toptype (No.

17.7.8.18) the antlers are normal, ending in two short tines and the first tine of the beam is simple and about 3 in. long. In the type (No. 17.7.8.17) the left antler is normal in shape and subequally bifid at the tip, but the first tine of the beam consists of two short points arising from a common base. In the right antler it is similar, but the tip of this antler is unusual in shape for Burmese Thamin, being expanded, compressed and decidedly semipalmate with about half a dozen snags behind the very short anterior apical tine and the back of the posterior portion of the antler above the two-pointed tine is two-edged, the inner edge bearing a series of small spicules.

When Thomas gave specific value to the palmate structure of the antlers in *platyceros* he seems to have overlooked the right antler of this type of *brucei* from the Ruby Mines, which is nearly intermediate between the normal antlers of the Burmese race, *thamin*, and of the typically Siamese race *platyceros*, even approaching the latter more than the former. Evidence of this is supplied by the antlers of an example of *platyceros* from Siam (Schomburgk, No. 65.11.2.1) which has the first tine of the beam similarly composed of two short spikes and the expanded part of the beam above it similarly two-edged posteriorly; but it differs in having the inner edge armed with two big spikes, one near its middle, the other at its upper end, and the outer edge armed with five big or tolerably big spikes; also by the subequality in size of the two normal terminal tines. Another antler of *platyceros* from Nhatrang, Annam (Vassal, N. 08.11.1.18) differs as much from the antler from Siam, above described, as the latter differs from the antler from the Ruby Mines. The first tine of the beam consists, as in the others, of a pair of spikes, but the part of the beam above it is more emphatically palmated, being more expanded and flattened, its posterior surface forming a single compressed edge armed with a number of mostly lobate, blunt spikes, apart from one near the middle of the edge which is considerably larger; it resembles the antler from Siam in having the two terminal tines normally large and subequal, but differs from it in that the posterior of these tines shares the palmation and has its hinder edge lobate to the tip (Fig. 7).

From the above-cited evidence of intergradation between the normal antlers of the Burmese Thamin and the palmated antlers of the Siamese form, I agree with G. M. Allen (*Bull. Amer. Mus. Nat. Hist.*, 22, p. 468, 1906) that *platyceros* is merely a subspecies of *Panolia eldi*. It is to be remembered too that according to Swinhoe's observations in Hainan (*Proc. Zool. Soc.* 1869, p. 655) the palmation of the antlers is acquired only when the Thamin is approaching maturity. It may be added that Thomas judging from Swinhoe's antlers, named the Hainan Thamin *Rucervus platyceros hainanus*. The evidence that it represents a distinct race is, in my opinion, quite inadequate.

THE BIRDS OF MYSORE.

BY

SÁLIM ALI.

With notes by Hugh Whistler.

PART III.

(Continued from Vol. xliii, No. 3, p. 341).

Acrocephalus stentoreus brunescens (Jerdon) The Great Indian Reed Warbler.

Specimen collected: 493 ♀ 28-12-39 Doddballapūr (2,900').

Elsewhere noted: Kabani river bank near Thūmsogē village (Begūr), Seringapatām, Palahally and other islets in Cauvery River, Marikānivē and islets in Vanivilās Sāgar.

[Measurements:

	Bill	Wing	Tail
1 ♀	25	87	75.5 mm.—H. W.]

Status? Uncommon and sparse.

Acrocephalus dumetorum Blyth. Blyth's Reed-Warbler.

Specimens collected: 72 ♀ 15-11-39, 104 ♀ 19-11-39 Bandipūr (3,000'); 212 ♀ 30-11-39 Manchgowdanhalli (2,500'); 301 ♀ 9-12-39 Hūnsūr (2,000'); 329 ♂ 13-12-39 Shimsha (2,500'); 382 ♀ 19-12-39 Nandidrūg (4,000'); 420 ♂ 23-12-39 Māklidrūg (2,800'); 510 ♂ 31-12-39 Nāmadachilumē (3,000'). *Biligirirangan Hills*: 47 ♂, 48 ♂, 49 ♀ 11-11-39 (4,000' Dodsampagi).

Elsewhere noted: Marikānivē, Jōgimaradi (near Chitaldrūg town); Kolār Gold Fields.

[Measurements:

	Bill	Wing	Tail
4 ♂ ♂	16.5-17.5	63-65	53-54 mm.
6 ♀ ♀	16-18	61.5-63.5	51-53.5 mm.—H. W.]

Winter visitor. Common. Met with singly in scrub and bushes, chiefly in deciduous biotope. Latest date recorded by the Survey 5 March.

Acrocephalus agricola Jerdon. The Paddy-field Warbler.

Specimens collected: 314 ♂ 11-12-39 Krishnarājsāgar (2,000'); 582 ♂, 583 ♂ 9-1-40 Hiriyūr (2,500').

Elsewhere noted: Māndya, Marikānivē.

[Measurements:

	Bill	Wing	Tail
3 ♂ ♂	14	58-58.5	54-56 mm.—H. W.]

Winter visitor. Common. Seen singly amongst irrigated paddy crops and reed-beds standing in water. The bird hops from stem to stem just above the water, clinging on sideways and often picking up tiny insects from the surface. It constantly utters a harsh *chir...chir*, etc.

Locustella nævia straminea Seeböhm. The Eastern Grasshopper-Warbler.

Specimens collected: *Biligirirangan Hills*: ♂ 29-12-32 (4,500'—Dodsampagi).

Elsewhere noted: Bābābūdan Hills (4,500'—Kemmanāgundi).

Winter visitor. Not uncommon in tall grass and sparse date scrub on hillsides, especially on the edge of *sholas*. A great skulker and flushed a second time only with difficulty.

Orthotomus sutorius guzurata (Latham) The Indian Tailor Bird.

Specimens collected, 364 ♂ 17-12-39 Sātnūr (2,500'); 401 ♂ 20-12-39, 432 ♂ 24-12-39 Dodballapur (2,900'); 543 ♂ 6-1-40 Marikānivē (2,500'). *Biligirirangan Hills*: M23(G) ♂ 20-9-34 (2,000—Satyamangala); M30(G) ♂ 13-7-34 (3,000'—Udahatti, E. base).

Elsewhere noted: Begūr, Chāmūndi Hill. Hūnsūr, Shimsha, Sivāsamūdrām, Nandidrūg, Bangalore, Thōndēbhāvi, Jōgimaradi (Chitaldrūg town environs), Settihālli, Kolār Gold Fields.

[Measurements :

	Bill	Wing	Tail
3 ♂ ad.	15-17.5	50.5-55	50-68.5 (summer tail)
1 ♂ imm.	14.5	47	39 mm.—H. W.]

Resident. Common. Restricted to deciduous biotope. Typical habitat: Scrub-and bush country.

Cisticola exilis erythrocephala Blyth. The Red-headed Fantail Warbler.

Specimens collected: 703 ♂, 704 ♂, 705 ♀, 706 o? juv., 707 ♂, 708 ♂ juv. 21-1-40, 723 o? 23-1-40, 734 ♀ 24-1-40 Bābābūdan Hills (3,500'-5,000'). Elsewhere not noted.

[Measurements :

	Bill	Wing	Tail
4 ♂ ♂	11-12	46.5-51	48.5-56.5 mm.
2 ♀ ♀	11.5	43-45	46.5-54 mm.
2 juv.	—	42-47	49-54 mm.

These adults are in nice fresh winter dress or just finishing the moult to it. The females are perhaps just distinguishable from the males in having the black markings of the upper plumage a little less heavily defined. The juveniles are above a mealier edition of the winter dress with the black markings considerably less in extent and definition. The lower plumage is pale sulphur in colour, faintly washed with buff on the flanks. In No. 706 the post-juvénal moult of the body feathers is well advanced on the lower surface.—H. W.]

Resident. Common in the Bābābūdan Hills among tall coarse grass and low *Strobilanthes* and bracken scrub on the open slopes and ridges alternating with *sholas*.

Cisticola juncidis cursitans (Franklin) The Streaked Fantail Warbler.

Specimens collected: 313 ♂ 10-2-39 Māndya (2,200'); 565 ♀ 8-1-40 Marikānivē (2,500').

[Measurements :

	Bill	Wing	Tail
1 ♂	11	53	31.5 mm.
1 ♀	11.5	47	29 mm.

Both these specimens appear to be in worn 'summer' dress.—H. W.]

I have an old note (19-12-32) of several seen on a grassy hillside at ca. 5,000' elevation in the Biligirirangans. After experience in the Bābābūdāns however, I am now inclined to believe that these were more probably *C. e. erythrocephala*.

Resident. Not common. Frequents tall grass maidāns, reeds standing on the margin of tanks and the borders of wet paddy fields.

The testes of No. 313 (10 December) were enlarged to 5×3 mm. Major Phythian-Adams has a c/4 collected near Gundlupet, 25-10-1935.

Franklinia gracilis albogularis (Walden) The South Indian Franklin's Wren-Warbler.

Specimens collected: 110 ♂ juv., 111 ♂, 112 ♀ 19-11-39 Bandipūr (3,300'); 371 ♂ 17-12-39 Sātñūr (2,500'); 407 ♀ 21-12-39, 427 ♂ 23-12-39 Mākhlidrūg (2,800'); 759 ♂ 28-1-40 Settihālli (2,500'). *Biligirirangan Hills*: ♂ 29-12-32 (5,000'—Dodsampagi); M70(H) ♂ 15-5-34 (4,000'—Shenemenhalla); M89(H) ♂ 18-5-34 (5,000'—Anaribetta); M123(H) ♂ 26-5-34 (4,000'—Bellāji); M67(G) ♂ 21-7-34, (3,000'—Udahatti, Eastern base).

[Measurements:

	Bill	Wing	Tail
8 ♂♂ (summer dress)	12-13.5	48-52	45.5-55 mm.
1 ♂ (winter dress)	12.5	48.5	50 mm.
3 juvs.	—	44-46	47.5-54 mm.

The most recent examination of the races of this species is by Ticehurst & Whistler (*Ibis*, 1939, pp. 761-763) and Mysore can now be added to the ascertained range of *F. g. albogularis*—H. W.]

Resident. Common. Restricted to deciduous biotope. Flocks in tall grass and secondary jungle.

Two males (19 November, 17 December) had enlarged testes—4×3 and 5×3 mm. respectively. A specimen of the former date was juvenile, evidently recently out of nest.

This Wren-warbler usually has 2 or 3 filo-plumes projecting behind the nape as in *Pycnonotus luteolus*. I have not seen this particular mentioned in published descriptions.

Phragmaticola aëdon (Pallas) The Thick-billed Warbler.

Specimens collected: 251 ♀ 3-12-39 Karāpūr (2,500'); 346 ♀ 15-12-39 Sātñūr (2,500') 540 ♂ 4-1-40 Nāmadachilumē (3,000'); 653 ♀ 16-1-40 Saklēshpūr (3,000').

[Measurements:

	Bill	Wing	Tail
4 ♀♀	20	83-85	85-88.5 mm.—H. W.]

Winter visitor. Frequent, but not common. Usually seen singly in undergrowth, preferentially in the dry-inter belt.

Hippolais caligata caligata Licht. The Tree-Warbler.

Specimens collected: 318 ♂, 319 ♂ 13-12-39 Sātñūr (2,500'); 423 ♀ 23-12-39 Mākhlidrūg (2,800').

[Measurements:

	Bill	Wing	Tail
2 ♂♂	13.5-14	62.5-63	50-50.5 mm.
1 ♀	13.5	60.5	51 mm.—H. W.]

Hippolais caligata rama (Sykes). Sykes's Tree-Warbler.

Specimen collected: 217 ♀ 1-12-39 Antarsāntē (2,500').

Elsewhere noted: Kolār Gold Fields (subspecies?).

[Measurements:

	Bill	Wing	Tail
1 ♀	15	59.5	51 mm.—H. W.]

Winter visitor. Fairly common, in deciduous scrub and bushes. At Sātñūr loose scattered 'flocks' of 12 to 15 birds were seen about mid-December.

Sylvia hortensis jerdoni (Blyth) The Ōrphean Warbler.

No specimen. Two solos were observed among bushes in a dry scrub-covered ravine at Sātñūr, 16-12-39.

Sylvia althoea Hume. Hume's Lesser Whitethroat.

Specimens collected: 229 ♂ 1-12-39 Antarsāntē (2,500'); 365 ♂ 17-12-39 Sātūr (2,500'); 422 ♀ 23-12-39 Mākīdrūg (2,800'); *Biligirirangan Hills*: M₃₁₋₃₂(G) ♂♂ 21-9-34 (2,000'—Satyamangala).

[Measurements:

	Bill	Wing	Tail
4 ♂♂	13.5-14	68.5-74	55-55.5 mm.
1 ♀	13	70	58.5—H. W.]

Fairly common winter visitor. Seen singly in deciduous biotope, in babool and other scrub. Earliest date 21 September.

Sylvia curruca blythi Ticeh. & Whistler. The Indian Lesser Whitethroat.

Specimen collected: 557 ♀ 7-1-40 Marikānivē (2,500').

[Measurements:

	Bill	Wing	Tail
1 ♀	12.5	65	54.5 mm.—H. W.]

Winter visitor. Rare. Frequents dry open sparsely scrubbed country.

Phylloscopus affinis (Tickell). Tickell's Willow Warbler.

Specimens collected: 381 ♂ 19-12-39 Nandīdrūg (4,000'); 385 o? 19-12-39 Mākīdrūg (2,800'); 683 ♀ 20-1-40 Bābābūdan Hills (5,000'—Kemangundi); *Biligirirangan Hills*: M₅₈(H) ♂ 20-4-34 (5,000'—Attikān).

[Measurements:

	Bill	Wing	Tail
1 ♂	11	59	44.5 mm.
1 ♀	12	55	42.5 mm.

This is the first record for Mysore State, a locality not therefore given in Ticehurst's monograph.—H. W.]

Winter visitor. Not uncommon in deciduous biotope, chiefly in scrub and small tree jungle. Also sparingly up to the edge of *sholas*.

Phylloscopus trochiloides viridanus Blyth. The Greenish Willow Warbler.

Specimens collected: 275 ♂ 5-12-39 Antarsāntē (2,500'); 302 ♂ 9-12-39 Hūnsūr (2,000'); 380 o? 19-12-39 Nandīdrūg (4,000'). *Biligirirangan Hills*: 24 ♂ 8-11-39, ♂ 28-12-32 (5,000'—Honnametti); M₂₁(G) ♂ 17-10-34 (4,000'—Edbūthi). Elsewhere noted: Bandipūr, Maddūr, Settihālli.

[Measurements:

	Bill	Wing	Tail
3 ♂♂	12-13	59-62	44.5-48.5 mm.—H. W.]

Winter visitor. Common. Affects wooded country, chiefly deciduous but also through the intermediate zone up to the edge of *sholas*. Seen singly in canopy foliage rather than in bushes. The constantly uttered call note *chirree* is distinctive.

Phylloscopus magnirostris Blyth. The Large-billed Willow Warbler.

Specimen collected: 856 ♂ 11-2-40 Jōg (2,000').

[Measurements:

	Bill	Wing	Tail
1 ♂	14.5	67.5	48 mm.

First record for Mysore.—H. W.]

Winter visitor. Rare. The specimen was shot in the Rāja Shola. It was a member of a mixed hunting party.

Phylloscopus occipitalis occipitalis (Blyth). The Large Crowned Willow Warbler.

Specimens collected: 105 ♀ 19-11-39 Bandipūr (3,300'); 646 ♂ 16-1-40 Saklēshpūr (3,000'); 853 ♂ 8-2-40 Āgūmbē (2,000'). *Biligirirangan Hills*: 50 ♂ 11-11-39, ♀ 28-12-32 (5,000'—Honnametti).

Elsewhere noted: Jāgar Valley (Bābābūdans).

[Measurements:

	Bill	Wing	Tail
3 ♂ ♂	14-15	66-71.5	50-53 mm.
2 ♀ ♀	13-14	64-65.5	48-48.5 mm.

These are the first records actually from Mysore State.—H. W.]

Winter visitor. Common in evergreen biotope and extending throughout the intermediate zone. It is almost invariably met with in the mixed hunting parties of which the most regular components, among other species, are *Culicicapa* and *Sitta frontalis*.

Prinia socialis socialis Sykes. The Ashy Wren-Warbler.

Specimens collected: 421 ♂? 23-12-39 Mākliḍrūg (2,800'). *Biligirirangan Hills*: M7(G) ♂ 8-8-34, M20(G) ♂ 10-7-34 (3,000' Ūdahatti, E. base).

Elsewhere noted: Seringapatām, Palahally, Begūr.

[Measurements:

	Bill	Wing	Tail	Tarsus
2 ♂ ♂ (summer plumage)	14-14.5	50-51.5	55-56	21 mm.— H. W.]

Resident. Not common. Affects grassland and scrub on the banks of streams, in deciduous biotope.

Prinia sylvatica sylvatica Jerdon. The Jungle Wren-Warbler.

Specimens collected: 368 ♂, 369 ♀ juv., 370 ♀ 17-12-39 Sātñūr (2,500'); 417 ♀ 22-12-39 Mākliḍrūg (2,800'); 504 ♂? 29-12-39 Thōṇḍebhāvi (2,500'); 592 ♂, 593 ♀ 10-1-40 Marikānivē (2,500').

Elsewhere noted: Bandipūr, Begūr, Jōgimaradi (Chitaldrūg town environs).

[Measurements:

	Bill	Wing	Tail
3 ♂ ♂	15	63.5-65	73-79 (winter)
1 ♀	14	53.5	65 (winter)
1 ♀ juv.	—	52	61.5

No. 370 ♀ in worn summer plumage, has tail 53 mm.—H. W.]

Resident. Common. Affects stony, sparsely scrubbed country in deciduous biotope. Call: *P'ty...p'ty...p'ty* etc.

No. 369 (17 December) was one of 2 juveniles just out of nest with stub tails and wobbly flight. It was being fed by the parents, the male of which (No. 368) had testes 5×3 mm. Most birds had evidently finished breeding by this date and were in an advanced stage of post-nuptial moult (to winter dress).

Prinia inornata inornata Sykes. The Indian Wren-Warbler.

Specimens collected: 142 ♂ 22-11-39 Bandipūr (3,300'); 324 ♂?, 325 ♀ 13-12-39, 360 ♂ 16-12-39 Sātñūr (2,500'); 435 ♀ 24-12-39, 479 ♂ 27-12-39 Dodballapūr (2,900'); 542 ♀ 6-1-40 Marikānivē (2,500').

[Most specimens either worn or moulting. No. 142, in heavy moult, might possibly be *P. i. franklinii*.—H. W.]

Resident. Common in deciduous biotope. It affects scrub country, as a rule less dry than that typical of *sylvatica* and less wet than that of *socialis*.

Irena puella puella (Latham). The Fairy Bluebird.

Specimens collected: 615 ♂ 13-1-40 Saklēshpūr (3,000'); 822 ♂ 4-2-40, 828 ♂, 829 ♀, 830 ♂ 5-2-40 Āgūmbē (2,500').

[Measurements :

	Bill	Wing	Tail
2 ♂♂ ad.	28-29	128-129	101-103 mm.
2 ♂♂ 1st. year	28.5-29	127-128	100.5-102.5 mm.
1 ♀	29	125	100.5 mm.

The two 1st. year males (Nos. 615 and 828) are quite indistinguishable from females except for the presence of odd—accidentally moulted—feathers of the adult plumage. I do not know definitely whether males breed in this female-like plumage or not, but it is perhaps significant that both of these birds have the organs quite undeveloped, whereas in the 2 adult males (Nos. 822 and 830) the testes measure 7×5 and 9×5 mm. respectively.—H. W.]

Resident. Common. Confined to evergreen biotope and found both in the 'plains' or plateau country and up to the highest *sholas*. A sharp, percussive *Peepit* is constantly uttered.

Oriolus oriolus kundoo Sykes. The Indian Oriole.

Specimens collected: 71 ♂ 15-11-39 Bandipūr (3,300'); 446 ♂ 26-12-39, 474 ♀, 482 ♀ 27-12-39 Doddballapūr (2,900'). Elsewhere noted: Seringapatām, Palahally islet (Cauvery), Saklëshpūr, Kolār Gold Fields, Biligirirangan Hills 3-5,000'.

[Measurements :

	Bill	Wing	Tail
2 ♂♂ ad.	32	134.5-143	82-87.5 mm.
2 ♀♀	31	136.5-139	85-85.5 mm.—H. W.]

Status uncertain. Probably partly resident and partly local migrant. The Survey found it fairly common in deciduous biotope, extending thence sparingly through the intermediate zone to the fringe of evergreen.

Oriolus chinensis diffusus Sharpe. The Black-naped Oriole.

Specimen collected: 859 ♀ 11-2-40 Jōg (2,000'). Elsewhere noted: Āgūmbē.

[Measurements :

	Bill	Wing	Tail	Tarsus
1 ♀	31	150	92.5	24 mm.—H. W.]

Evidently a sparse winter visitor. Met with in the moist-inter belt. Its pleasant, melodious calls are like the Indian Oriole's, but they possess a distinctive quality, hard to describe, which facilitates differentiation by ear in the field.

Oriolus xanthornus maderaspatensis Franklin. The South Indian Black-headed Oriole.

Specimens collected: 181 ♀ 28-11-39 Antarsāntē (2,500'); 790 ♂ 31-1-40 Setthihālli (2,500'). *Biligirirangan Hills*: M1(G)? ♂ 14-9-34, M9(G)? 15-9-34 (2,000'—Satyamangala).

Elsewhere noted: Edbūthi (4,000'—Biligirirangans), Bandipūr, Chāmūndi Hill.

[Measurements :

	Bill	Wing	Tail
3 ♂♂	29.5-31	136.5-140	81.5-85.5 mm.
1 ♀	29	130	83.5 mm.—H. W.]

Resident. Fairly common. Affects deciduous biotope extending sparingly into the dry-inter belt.

The intestine of No. 181 was infested with Cestode worms.

Gracula religiosa intermedia (Cuvier) The Southern Grackle.

Specimens collected: 751 ♂ 27-1-40 Setthihālli (2,500'). *Biligirirangan Hills*: 37 ♂, 38 ♀, 39 ♂ 10-11-39 (4,000'—Bedagūli); ♀ 21-12-32, M18 (H) ♀ 13-3-34, M22(H) ♀ 2-3-34, M64(H) ♂ 25-4-34, M3(H) ♀ 9-5-34, M8(H) ♀ 7-5-34 (4,000'—Honnametti).

Elsewhere noted: Bandipūr, Kākenhālla, Nāmadachilumē, Saklëshpūr.

[Measurements :

	Bill-	Wing	Tail
4 ♂♂	29-32	147-5-154-5	69-71-5 mm.
6 ♀♀	28-30-5	142-149	65-69 mm.—H. W.]

Resident. Common. Noisy flocks. Typical habitat: Intermediate zone, wandering freely into either extreme near the edge, and up to the highest *sholas*.

The ♀ of 10 November (No. 38) had a fairly mature ovary with the largest follicle over 2 mm. in diameter. But no other evidence as to the breeding season was obtained.

Pastor roseus (Linn.) The Rosy Pastor.

Specimens collected: 139 ♀, 140 ♂ 22-11-39 Bandipūr (3,000'—Hangala village); 388-393 ♂♂♀♀ 20-12-39 Dodballapūr (2,900').

Elsewhere noted: Seringapatām. (Hume mentions a specimen obtained near Gündlūpet (S. F., x, 401).

Winter visitor. Not common by its Deccan standards. Small flocks seen about cultivation.

Sturnia malabarica blythii (Jerdon) Blyth's Myna.

Specimens collected: 176 ♀, 177 ♀, 178 ♀ 25-11-39 Bandipūr (3,000'—Kākenhālla); 243 ♀ 2-12-39 Manchgowdanhalli (2,500'); 688 ♂, 689 ♂ 20-1-40 Jāgar Valley (2,500'—Bābābūdan Hills); 762 ♂ 28-1-40 Settihālli (2,500').

Elsewhere noted: Palahally islet (Cauvery River, near Seringapatām).

[Measurements :

	Bill	Wing	Tail
3 ♂♂	23-24	103-105	63-67 mm.
4 ♀♀	22-23	97-5-103-5	59-64 mm.

This series has at last settled the question—left in the air in both editions of the Fauna—as to what the female of this race is like. There are 4 adult females which differ merely in the amount of white on the forehead and fore-crown. From them it is now possible to say that the adult ♀ differs from the adult ♂ as follows:

(1) The white on the head is confined to the forehead and forepart of the crown, the rest of the crown and nape being the same colour as the back but much streaked with pale grey.

(2) The silvery grey on the wings and tail is not so pronounced.

(3) The sides of the head and neck are largely grey instead of white.

(4) The pure white on the underparts is confined to the chin and throat; the breast is sullied with grey and merges into the creamy-rufous of the abdomen and flanks which is very different to the rich rufous of these parts in the ♂; undertail coverts paler and more fulvous than in the ♂.

The adult ♀ differs from the adult ♀ of the typical race as follows:

(1) In the purer more silvery grey (as opposed to more brownish grey) of the upper parts.

(2) In the much paler colour of the underparts, pure white on the chin and throat, white sullied with grey and rufous on the breast, creamy rufous on the rest of the underparts and flanks, and pale rufous on the undertail coverts. —H. W.]

Resident. Common. Restricted to deciduous biotope. Affects teak and other forest plantations, and open scrub and secondary jungle.

Temenuchus pagodarum (Gmelin). The Brahminy Myna.

Specimens collected: 342 ♂, 343 ♂ 15-12-39 Sātnūr (2,500'); 449 ♂ 26-12-39 Dodballapūr (2,900'). *Biligirirangan Hills*: M27(G) ♂ 12-7-34 (3,000'—Ūdahatti, E. base).

Elsewhere noted: Bedagūli, Bandipūr, Gündlūpet, Palahally and other Cauvery islets, Seringapatām, Nāmadachilumē, Hiriyaūr, Saklēshpūr, Settihālli, Kolār Gold Fields.

[Measurements :

	Bill	Wing	Tail
4 ♂♂	20-22	104-112	63-74-5 mm.—H. W.]

Resident. Common and abundant. Restricted to deciduous biotope. It affects scrub and secondary jungle in the neighbourhood of human habitations.

Major Phythian-Adams has a clutch of 5 eggs taken at Gündlupet, 4-7-1935.

Acridotheres tristis tristis (Linn.) The Common Myna.

Specimen collected: 466 ♀ 27-12-39 Doddballapūr (2,900').

Noted: Bandipūr, Nāmadachilumē, Marikānivē, Settihālli, Mysore City, Bangalore, Kolār Gold Fields, and elsewhere.

[Measurements:

	Bill	Wing	Tail
1 ♀	broken	144	86 mm.—H. W.]

Resident. Common and everywhere more or less commensal on Man. It was, however, not met with in evergreen biotope, nor at elevations above ca. 3,500'. At Ootacamund in the Nilgiris (7,500'), the Jungle Myna seemed to have displaced this species completely (March 1940).

Æthiopsar fuscus mahrattensis (Sykes). The Southern Jungle Myna.

Specimens collected: 775 ♂, 776 ♀ 30-1-40 Settihālli (2,500'). *Biligirirangan Hills*: M20(H) ♀ 4-3-34 (4,000'—Dodsampagi); M65(H) ♂ 26-4-34 (4,000'—Bellāji); M39(G) ♂ 16-7-34 (3,000'—Udahatti, E. base).

Elsewhere noted: Bedagūli, Bandipūr, Nāmadachilumē, Saklēshpūr.

[Measurements:

	Bill	Wing	Tail
3 ♂♂	26-28	126-134	72.5-79 mm.
2 ♀♀	25-27	120.5-130.5	73-78 mm.—H. W.]

Resident. Common but inexplicably patchy. Its distribution is virtually restricted to deciduous biotope—secondary jungle—but it is sporadically met with in the intermediate zone also. Frequently found in association with *Sturnia*, *Temenuchus* and *Acridotheres tristis*.

[Sturnopastor contra The Pied Myna.

I have a doubtful and unconfirmed sight record from Bandipūr, 15-11-39].

Ploceus philippinus philippinus (Linn.). The Baya or Common Weaver Bird.

No specimens.

Noted: Bandipūr (old nest colonies only), Seringapatām, Palahally and other Cauvery islets (old nests only), Marikānivē (old nests; no Bayas), Kolār Gold Fields (old nest colony at Bētmangala Tank; no Bayas!).

Confined to deciduous biotope; occasionally met with in the dry-inter belt. A marked local migrant, moving about the country a great deal with the seasons. The majority of the disused nests were made of paddy leaf. This crop is grown in many localities during the S.-W. Monsoon only, thus it would seem that the seasonal movements of this species are controlled in a large measure by the incidence of paddy cultivation.

Ploceus manyar [flaviceps Lesson]. The Striated Weaver Bird.

Not met with by the Survey. Major Phythian-Adams has 2 clutches of 3 eggs each taken near Gündlupet, 11-9-1927 from nests built in reeds.

Munia malacca (Linn.) The Black-headed Munia.

No specimens.

Noted: Seringapatām.

Small numbers of this Munia were observed on the tall grass and vegetation covered islets in the Cauvery River near Palahally island—the newly established Bird Sanctuary. The birds kept largely to swampy patches with *Polygonon*, and *Pandanus* thickets etc.

On 27 November a pair was nest-building in a tussock of tall grass at the river's edge.

***Uroloncha striata striata* (Linn.)** The White-backed Munia.

Specimens collected: 292-296 ♂ ♀ ♂ ♀ 8-12-39 Seringapatām (2,000'); 476 o? juv. 478 ♀ 27-12-39 Dodballapūr (2,900'). *Biligirirangan Hills*: M19(G) ♂ 19-9-34 (2,000'—Satyamangala); M24(G) ♂ 12-7-34 (3,000'—Udahatti, E. base). Elsewhere noted: Shimsha, Sivāsamūdrām, Settihāllī.

[Measurements :

	Bill	Wing	Tail
5 ♂ ♂	12.5-13	51.5-54	38-39 mm.
2 ♀ ♀	13	53.5-54	37-39 mm.
2 juvs.	—	53-54.5	36-37 mm.

The juveniles are very similar to the adult though the shaft streaks are less defined on the upper plumage. The black of the throat and breast are duller, and the feathers of the breast have narrow brown edges which give a slightly squamated appearance.—H. W.]

Resident. Not uncommon. Restricted to deciduous biotope. Flocks in scrub and lightly wooded country about cultivation.

Breeding was evidently in progress in December. Most of the adult specimens had mature gonads: testes 5×4 to 6×5 mm.; largest ovarian follicle (in 295) 7 mm. in diameter (soft egg). The flocks at this period contained many juveniles lately out of nest.

***Uroloncha kelaarti jerdoni* (Hume.)** The Rufous-bellied Munia.

Specimen collected: *Biligirirangan Hills*: M71(H) ♀ 16-5-34 (4,000'—Bellāji). Elsewhere not noted.

[Measurements :

	Bill	Wing	Tail
1 ♀	13.5	58	— mm.—H. W.]

Not met with by the Survey.

***Uroloncha malabarica* (Linn.)** The White-throated Munia.

Specimens collected: 186 ♂ 28-11-39 Antarsāntē (2,500'); 428 ♂ 23-12-39 Mākliḍrūg (2,800'); 437 ♂ 24-12-39 Dodballapūr (2,900'); 566 o? juv., 567 ♂, 568 o? juv. 8-1-40 Marikānivē (2,500').

Elsewhere noted: Bandipūr, Karāpūr, Shimsha, Sivāsamūdrām, Kolār Gold Fields.

[Measurements :

	Bill	Wing	Tail
3 ♂ ♂	11-11.5	54-56	44.5-45.5 mm.
2 juvs.	—	55-56.5	41-44 mm.—H. W.]

Resident. Common. Restricted to deciduous biotope. Affects scrub and light secondary jungle in the neighbourhood of cultivation and human habitations.

Two of the specimens had gonads enlarged to breeding size. No. 186 (28 November; testes 6×4 mm.) moreover, was one of a pair working on a half-built nest ca. 6 ft. up in an *Acacia* tree in open scrub country. Two of the specimens of 8 January were juveniles lately out of nest.

***Uroloncha punctulata lineoventer* (Hodgson)** The Spotted Munia.

Specimens collected: 87 ♂ 17-11-39 Bandipūr (3,300'); 312 ♀ 10-12-39 Māndya (2,200'). *Biligirirangan Hills*: M42(G) o? 17-7-34 (3,000'—Udahatti, E. base). Elsewhere noted: Antarsāntē, Karāpūr, Seringapatām, Palahally Island (Cauvery), Hiriyyūr.

[Measurements :

	Bill	Wing	Tail
1 ♂	12.5	57	39 mm.
1 ♀	13	55	34.5 mm.—H. W.]

Resident. Common. Restricted to deciduous biotope. Found in light secondary jungle with patches of grassland and cultivation.

The specimens of November-December were both in the spotted breeding plumage. Testes 7×5 mm; ovary granular and mature.

Amandava amandava amandava (Linn.) The Indian Red Munia.

Specimens collected: 415 ♂ 22-12-39, 424 ♂ 23-12-39 Mäklidrüg (2,800'); 458 ♂ 26-12-39 Dodballapür (2,900'); 601 ♂ 11-1-40 Hiriyür (2,000'). Elsewhere noted: Mändya, Marikänivē.

[Measurements:

	Bill	Wing	Tail
4 ♂♂	10-11	48.5-49	35-38 mm.—H. W.]

Resident. Fairly common. Restricted to deciduous biotope. In flocks, among reeds and tall grass by *jheels*, swamps and sometimes streams.

Three of the specimens (December-January) had testes enlarged to breeding size or almost (8×4 , 7×4 , 5×4 mm.). They were all in the crimson breeding plumage. On 7 January (Marikänivē) a ♂ was observed carrying floss from a bulrush head for its nest.

Carpodacus erythrinus roseatus (Blyth). The Common Indian Rose-Finch.

Specimens collected: 514 ♂ 31-12-39, 522 ♂ 2-1-40 Nāmadachilumē (3,000'); 699 ♂ 21-1-40, 731 ♂, 732 ♂ 24-1-40 Bābābūdan Hills (4,000'-4,500'—Kemman-gūndi). *Biligirirangan Hills*: M15(H) [♀], M46(H) ♂ 8-4-34 (5,000'—Honnametti).

[Measurements:

	Bill	Wing	Tail
6 ♂♂	14.5-15	84-86.5	57-59.5 mm.

These birds agree with those collected in the Eastern Ghāts and Travancore-Cochin Surveys in their rich colouration above and below and the much greater extent of colour on the lower parts which covers the vent and lower tail coverts; and they are in marked contrast to the paler, less generally red typical race procured by the Central India Survey. Fortunately in make of skin and date of collecting the two forms are perfect for comparison.—H. W.]

Winter visitor. Not common. Affects *Lantana* scrub and bushes on the edge of coffee plantations and outskirts of *sholas*, feeding on a large variety of seeds and berries.

Gymnorhis xanthocollis xanthocollis (Burton). The Yellow-throated Sparrow.

Specimens collected: 185 ♂ 28-11-39, 278 ♂ 5-12-39 Antarsāntē (2,500'); 431 ♂ 24-12-39 Dodballapür (2,900'). *Biligirirangan Hills*: M50(G) o? 18-7-34 (3,000'—Udahatti, Eastern base).

Elsewhere noted: Seringapatām, Nāmadachilumē, Marikänivē, Saklēshpür, Kōlār Gold Fields.

[Measurements:

	Bill	Wing	Tail
4 ♂♂	14.5-15.5	81-83.5	49-51.5 mm.—H. W.]

Resident but marked local migrant. Restricted to deciduous biotope. Found in light secondary jungle and about cultivation and outlying human habitations.

Passer domesticus indicus Jardine & Selby. The Indian House-Sparrow.

Specimens collected: *Biligirirangan Hills*: M70-71(G) ♂♂ 21-7-34 (3,000'—Udahatti, Eastern base).

Noted: Bandipür, Mysore, Bangalore, Chāmūndi Hill, Devarbetta Hill, Sātūr, Halēbid, Kōlār Gold Fields and elsewhere. *Biligirirangans*: Poonjūr, Hasanūr (not on or about Honnametti or Attikān Estate bungalows or cooly lines—4,000'-5,000').

Resident. Ubiquitous in the 'low' or plateau country; absent in the hills above about 3,500'. A confirmed commensal of Man and invariably present about towns, villages and outlying homesteads.

On 12 January sparrows were observed nesting freely within the magnificent old temples at Halēbid and bestrewing the floor with their droppings

and rubbish. Major Phythian-Adams has several clutches (mostly of 3 eggs) collected in or near Mysore City between 25 May and July (1931). Breeding seems to continue more or less throughout the year.

Emberiza buchanani Blyth. The Grey-necked Bunting.

Specimens collected: 569-572 ♀♂♀♂ 8-1-40, 595 ♀ 10-1-40 Marikānivē (2,500').

Elsewhere not noted.

[Measurements:

	Bill	Wing	Tail
2 ♂♂	14-15	85-88.5	69.5-71.5 mm.
3 ♀♀	14.5-15	81.5-86	67-72 mm.—H. W.]

Winter visitor. Fairly common about Marikānivē. Small flocks in open, stony, sparse scrub country with babool trees—Rock Bush-Quail facies. Its flight is very like a pipit's, but while alighting the white outer tail feathers are more conspicuous.

Emberiza bruniceps Brandt. The Red-headed Bunting.

Specimens collected: 597-600 ♀♀♀♂ 11-1-40 Hiriyr (2,000').

Elsewhere not noted.

[Measurements:

	Bill	Wing	Tail
1 ♂	16	86.5	69 mm.
3 ♀♀	15.5-16	82.5-85	65-67 mm.—H. W.]

Winter visitor. The above was the first and only meeting with this bunting in Mysore State. Flocks of some hundreds were observed feeding on the ground among stony castor fields (in deciduous biotope). When settled on the surrounding babool trees the birds looked like a profusion of yellow blossoms.

Emberiza melanocephala Scopoli. The Black-headed Bunting.

No specimens. At least one example was definitely identified amongst the flocks of *bruniceps* at Hiriyr, 11-1-40.

Martula urbica urbica (Linn.) The House-Martin.

Not met with by the Survey. Apparently a rare and sporadic winter visitor to south-western India. There is a specimen from Shimoga in the Hume Collection dated 27-4-1875. The report of a colony nesting under a large overhanging rock in the bed of the Tunga River in Shimoga Dist., quoted by Stuart Baker (iii, 227) from N. & E., ii, 177 is possibly mistaken. At any rate there is no evidence now available in support of it.

Riparia rupestris (Scopoli). The Crag Martin.

Specimens collected: 680 ♂?, 681 ♀ 20-1-40, 719 ♀, 720 ♂? 23-1-40 Bābā-būdan Hills (5,000'—Kemmanagundi); 870 ♂ 12-2-40 Jōg (2,000').

Elsewhere not noted.

[Measurements:

	Bill	Wing	Tail
1 ♂	11.5	129	53 mm.
2 ♀♀	11.5-12	127.5-128.5	54-56.5 mm.—H. W.]

Presumably a winter visitor. At Kemmanagundi 30 or more of these birds were observed hawking insects in company with *R. concolor* above a grass covered hilltop with outcrops of sheet rock. At Jōg, small numbers were seen about and above a forest road clearing. Both the specimens of 23 January were very fat.

Its larger size, paler underparts and white-spotted rectrices, conspicuous when the bird wheels in overhead flight, help to differentiate it on the wing from the Dusky Crag Martin.

Riparia concolor (Sykes). The Dusky Crag Martin.

Specimens collected: 377 ♂ 19-12-39 Nandidrūg (4,000'). Biligirirangan Hills: 52 ♀ 11-11-39 (5,000'—above Dodsampagi).

Elsewhere noted: Bābābūdan Hills (4,000'-5,000'—Kemmanḡūndi). It was certainly present in other localities also, but I seem to have no specific notes.

[Measurements :

	Bill	Wing	Tail
1 ♂	9.5	110	46.5 mm.
1 ♀	10.5	110	46 mm.—H. W.]

Resident. Patchily distributed and not common. Small numbers usually observed hawking insects above grassy hilltops with sheet rock and precipices.

Major Phythian-Adams has a c/2 taken at Gündlūpet, 21-7-1927.

Hirundo rustica gutturalis Scopoli. The Eastern Swallow.

Specimens collected: 303-306 ♀ ♂ ♂ 9-12-39 Hūnsūr (2,000'); 441 ♂ 24-12-39 Dodballapūr (2,900').

Elsewhere noted: Antarsāntē, Begūr, Kolār Gold Fields.

[Measurements :

	Bill	Wing	Central tail	Outer tail
2 ♂ ♂ ad.	11.5-12	112.5-116.5	27.5-41	83 mm.
1 ♀ ad.	11	110	39	73 mm.
2 ♂ ♂ juv.	11-11.5	108-110	39.5-43.5	53-61 mm.

—H. W.]

Winter visitor. Fairly common. Usually seen hawking insects on river banks and about tanks and irrigation reservoirs.

Hirundo smithii filifera Stephens. The Wire-tailed Swallow.

No specimens.

Noted: Gündlūpet, Hangala (near Bandipūr), Palahally island (Cauvery River), Seringapatām, Marikānivē (Vanivilās Sāgar); Mysore (Krishnārājsāgar), Kolār Gold Fields.

Resident. Met with in small numbers by tanks and rivers in deciduous biotope.

Hirundo daurica erythropygia Sykes. The Red-rumped Swallow.

Specimens collected: 378 ♀ 19-12-39 Nandidrūḡ (4,000'); 700 ♂ 21-1-40 Bābābūdan Hills (4,500'—Kemmanḡūndi); *Biligirirangan Hills*: 53 ♂ 11-11-39 (5,000'—Dodsampagī) M6(G) o? 24-7-34; M83(G) ♂ 8-8-34 (3,000'—Ūdahatti, E. base).

Elsewhere noted: Bandipūr, Chāmūndi Hill (Mysore City environs); Settihālli, Kolār Gold Fields.

[Measurements :

	Bill	Wing	Central tail	Outer tail
1 ♂ ad.	10	115	44	75.5 mm.
1 ♀ ad.	10	—	43.5	69 mm.
2 ♂ ♂ juv.	—	108.5-116	39	59-71 mm.

—H. W.]

Resident. Common. Less attached to the neighbourhood of water than the two preceding species. Usually seen hawking winged insects over grassy hilltops and forest clearings, and often in association with Crag Martins and Swifts.

Motacilla alba dukhunensis Sykes. The White Wagtail.

Specimens collected: 222 ♂, 223 ♀ 1-12-39 Antarsāntē (bank of Kabani River near Begūr); 492 ♀ 28-12-39 Dodballapūr (2,900').

Elsewhere noted: Mysore City environs (Brindāvan Gardens); Āḡūmbē.

[Measurements :

	Bill	Wing	Tail
1 ♂	16	91	88 mm.
2 ♀ ♀	16-16.5	85.5-86	82-86 mm.—H. W.]

Winter visitor. Fairly common. By rivers, streams and tanks, and on flooded lawns etc.

Motacilla alba personata Gould. The Masked Wagtail.

No specimens.

Noted: Mysore City environs (on flooded lawns in Brindāvan Gardens, and elsewhere), Kolār town.

Winter visitor. Apparently uncommon.

Motacilla maderaspatensis Gmelin. The Large Pied Wagtail.

Specimens collected: 130 ♂, 131 ♀ 21-11-39 Gūdalūr Ghāt (near Kākenhalla 3,000'); 328 ♂ 13-12-39 Shimsha (2,500'); 469 ♂, 480 ♀ 27-12-39, 490 ♂ 28-12-39 Dodballapūr (2,900').

Elsewhere noted: Seringapatām, Palahally and other islets in Cauvery River, Marikānivē (Vanivilās Sāgar), Kolār Gold Fields.

[Measurements:

	Bill	Wing	Tail
3 ♂ ♂	20-20.5	100-104	99-106.5 mm.
2 ♀ ♀	18.5-19	95-98	99-101 mm.
1 ♂ juv.	—	100	98.5 mm.—H. W.]

Resident. Not common, but frequent at smooth running rocky streams, tanks, etc. From the state of their gonads (testes 10×6 mm.; ovary granular) the specimens of 27 December (not a pair!) appeared to be breeding or about to breed. Courtship was observed in a pair on 9 January.

Motacilla cinerea caspica S. G. Gmelin. The Eastern Grey Wagtail.

Specimens collected: 126 ♂, 127 ♀ 20-11-39 Bandipūr (3,300'); *Biligirirangan Hills* 0? 19-12-32, M66(H) ♀ 26-4-34, M1(G) ♂ 9-10-34 (4,000'5,000'—Honnammetti); M28(G) ♂ 19-10-34 (4,000'—Bellāji).

[Measurements:

	Bill	Wing	Tail
3 ♂ ♂	16-17	83.5-85	92-95 mm.
2 ♀ ♀	16	80.5-82	89.5-92 mm.—H. W.]

Winter visitor. Common. Earliest date 9 October; latest 26 April. Met with singly on paths through coffee and cardamom plantations, and at forest streams and trickles. By the beginning of March (*Biligirirangans*) some individuals had already acquired summer plumage.

Motacilla flava beema (Sykes). The Indian Blue-headed Wagtail.

Specimens collected: [585 ♀], 586 [♂] 9-1-40 Hiriūr (2,500').

[Measurements: 1 ♂ Bill 16, Wing 81, Tail 70 mm.]

Motacilla flava thunbergi Billberg. The Grey-headed Wagtail.

Specimens collected: 310 ♂ 10-12-39 Māndya (2,200'); [400 ♀ 20-12-39 Dodballapūr (2,900')]; 824 ♂ 4-2-40 Āgūmbē (2,500').

[Measurements: 2 ♂ ♂ Bill 16-16.5, Wing 84-84.5, Tail 72.5-73.5 mm.

Nos. 400 and 585 are females and the race cannot be stated with certainty.—H. W.]

Elsewhere noted (subspecies?): Krishnārājsāgar Dam and Brindāvan Gardens (Mysore City environs), Kolār Gold Fields.

Winter visitor. Not common. Met with on flooded lawns, on the wet grassy margins of tanks, squelchy paddy stubble etc.

Dendronanthus indicus (Gmelin). The Forest Wagtail.

Specimens collected: 242 ♂ 2-12-39 Manchgowdanhalli (2,500'); 246 ♀ 3-12-39 Antarsāntē (2,500'); 628 0? 14-1-40 Saklēshpūr (3,000'). *Biligirirangan Hills*: M18(G) ♀ 19-9-34 (2,000'—Satyamangala).

Elsewhere noted: Jāgar Valley (2,500'—Bābābūdans).

[Measurements:

	Bill	Wing	Tail
1 ♂	18	80	69 mm.
2 ♀ ♀	17	80-82	68.5-69.5 mm.—H. W.]

Winter visitor. Earliest date 19 September. Usually met with singly on the ground in mixed bamboo forest, and in coffee and cardamom plantations.

Anthus trivialis trivialis (Linn.). The Tree-Pipit.

Specimens collected: 347 ♂ 15-12-39 Sātnūr (2,500'); 430 ♂ 24-12-39, 453 ♀ 454 ♀ 26-12-39, 470 ♀ 27-12-39 Dodballapūr (2,900').
Sight records not subspecific.

[Measurements:

	Bill	Wing	Tail
2 ♂♂	15	87.5-90	64 mm.
3 ♀♀	14-15	85-87	61-62 mm.

It is very difficult to be sure of the racial identity of Tree-Pipits, but on the whole—especially judging by the beaks—it seems safest to consider these the typical race.—H. W.]

Winter visitor. Fairly common. Met with in loose flocks feeding on the ground in chili and *toovar* fields.

Anthus hodgsoni ssp.? The Indian Tree-Pipit.

Specimens collected: 686 ♀ 20-1-40 Bābābūdan Hills (4,500'—Kemman-gūndi); Biligirirangan Hills: ♀ 17-12-32, ♀ 21-12-32, ♀ 28-12-32, ♀ 29-12-32, M17(G) o? 19-9-34 (5,000'—Honnametti).
Sight records omitted.

[Measurements:

	Bill	Wing	Tail
5 ♀♀	14-15.5	82.5-84	60.5-62 mm.

These birds are all rather intermediate in character though they seem, if anything, rather nearer to *A. h. berezowskii*.—H. W.]

Winter visitor. Earliest date 19 September. Met with in the hills above ca. 3,500' in loose parties of 5 or 6, feeding on the ground in coffee and cardamom plantations. Unlike *A. t. trivialis* I do not seem to have come across it outside evergreen biotope or in the 'plains' or plateau country of the State.

Anthus similis similis Jerdon. The Rufous Rock-Pipit.

Specimens collected: 379 ♂ 19-12-39 Nandidrūg (4,000'). Biligirirangan Hills: 45 ♂ 11-11-39 (5,500'—above Dodsampagi); 58 ♂ 11-11-39, 63 o? 12-11-39 (5,500'—Honnametti); M109(H) ♀ 24-5-34 (4,000'—Edbūthi).
Elsewhere noted: Bābābūdan Hills 5,000' (above Kemman-gūndi).

[Measurements:

	Bill	Wing	Tail
3 ♂♂	19-21	94-95.5	75.5-79 mm.
1 juv.	—	91	75 mm.—H. W.]

Resident. Not common, but frequent. Single birds or scattered pairs observed on grassy hilltops with rocky outcrops—not below ca. 3,500' elevation!

Anthus rufulus rufulus Vieillot. The Indian Pipit.

Specimens collected: 151 ♂, 152 ♂ 23-11-39 Bandipūr (3,300'); 190 ♂ 28-11-39, 203 ♂ 30-11-39, 230 ♀ 1-12-39 Antarsāntē (2,500'); 259 ♂ 4-12-39 Karāpūr (2,500'); 483 ♂ 28-12-39 Dodballapūr (2,900'); 650 ♂, 651 ♂ 16-1-40 Saklēshpūr (3,000'); 702 ♂, 21-1-40, 722 ♂ 23-1-40 Bābābūdan Hills (4,500'—5,000'—Kemman-gūndi). Biligirirangan Hills: M10 (H) o? 8-5-34, M28 (H) ♂, M37(H) ♂ 11-5-34 (5,000'—Honnametti); M68-69(H) ♂ ♀ 15-5-43 (4,000'—Shenepenhālla); M80(H) ♂ 18-5-34 (4,000'—Bellāji); M110(H) ♂ 24-5-34, M117-118(H) ♀ ♀ 25-5-34 (4,000'—Edbūthi).

[Measurements:

	Bill	Wing	Tail
15 ♂♂	15.5-17.5	80.5-88.5	56-62 mm.
4 ♀♀	15-17	78.5-82	54-57 mm.

I have already been into the question of the races of this species at some length in the Travancore Survey (*J.B.N.H.S.*, xxxviii, pp. 765-766). The Mysore series, though variable and containing one or two dark birds, may certainly be taken as *A. r. rufulus*. The Biligirirangan birds are so worn that it is unsafe to be positive about their race: they do however seem rather dark, and fresh

specimens might show that they would better be grouped with *malayensis*.—H. W.]

Resident. Common. Affects open grass and stony country, hill as well as plain, and fallow cultivation.

A number of males from about the end of December onward showed marked development in their testes—largest 8×6 mm. (16 January). There are, unfortunately, no particulars of the gonads of the Biligiri specimens all collected in May.

Anthus campestris griseus Nicoll. The Eastern Tawny Pipit.

Specimens collected: 502 ♀ 29-12-39 Thōndēbhāvi (2,500').

[Measurements: 1 ♀ Bill 17, Wing 88, Tail 68 mm.—H. W.]

Winter visitor. A loose party was met with in open, sparsely scrubbed stony country.

From the body cavity (probably ruptured intestine) of the specimen were removed some cestode worms [*Anonchotaenia? globata* (Linst., 1879)], and from the eyesocket (behind eyeball!) a nematode *Oxyspirura* sp. In spite of these the bird appeared in good condition.

Anthus thermophilus Jerdon. Blyth's Pipit.

Specimens collected: 258 ♀ 4-12-39 Karāpūr (2,500'); 271 ♂? 5-12-39 Antarsāntē (2,500'); 358 ♀, 359 ♀ 16-12-39 Sātūr (2,500').

[Measurements: 3 ♀♀ Bill 16.5-17, Wing 89.5-91.5, Tail 63.5-69 mm.

I do not think the idea that this is a race of *campestris* can be maintained any longer.—H. W.]

Winter visitor. Loose flocks in dry cultivation and fallow land.

Calandrella brachydactyla (or *acutirostris*?) Short-toed Lark.

No specimens.

A flock of about 30 was observed in open dry cultivation and fallow land about Hangala village (2,500'—below Bandipūr) 24-11-39.

Mirafra erythroptera erythroptera Jerdon. The Red-winged Bush-Lark.

Specimen collected: 594 ♂ 10-1-40 Marikānivē (2,500').

Sight records not reliable specifically, but besides the localities represented by specimens, *Mirafra* larks were observed at Bandipūr and in Kolār Gold Fields.

[Measurements: 1 ♂ Bill 14, Wing 82, Tail 56 mm.—H. W.]

Resident. Not common. The specimen was the only one seen in this locality: it was in dry, stony, sparsely-scrubbed laterite country—Rock Bush-Quail facies. Testes 5×4 mm.

Mirafra javanica cantillans Blyth. The Singing Bush-Lark.

No specimen procured by the Survey.

I include this in the Mysore list on the authority of Major Phythian-Adams who collected a clutch of 3 eggs near Seringapatam on 25-4-1931 and shot one of the owners. I have not seen the specimen.

Mirafra affinis affinis Jerdon. The Madras Bush-Lark.

Specimens collected: 266 ♀ 4-12-39 Karāpūr (2,500'); 320 [♂] 13-12-39 Sātūr (2,500'); 409 ♀ 21-12-39 Mākliḍrūg (2,800'); 444 ♂ 24-12-39, 477 [♂] 27-12-39 Dodballapūr (2,900'); 536 [♂] 4-1-40 Nāmadachilumē (3,000'); *Biligirirangan Hills*: M73(G) ♂ 22-7-34, M100(G) ♂ 27-7-34 (3,000'—Udahatti, Eastern base).

[Measurements:

	Bill	Wing	Tail
5 ♂♂	15.5-17	84-88	45-49 mm.
1 ♀	16	81.5	44 mm.
1 ♀ juv.	—	76	39.5 mm.—H. W.]

Resident. Not common but frequent, in small numbers, in open stony sparsely scrubbed country. Unfortunately I have no special notes concerning its local distribution, but it is perhaps not without some significance that the only example of *erythroptera* procured in Mysore was on laterite soil, whereas

all the specimens of *affinis* were on the normal brownish soil. This point deserves further observation and scrutiny in the field.

Embedded in the thigh muscles of No. 444 was found a larva of an Acanthocephalan worm (?*Centrorhynchus* sp.).

The testes of this specimen (24 December) measured 5×4 mm.

Galerida malabarica (Scopoli). The Malabar Crested Lark.

Specimens collected: 253-257 ♂♂♀♀ 4-12-39 Karāpūr (2,500'); 679 ♂ 20-1-40 Bābābūdan Hills (5,000'—above Kemmangūndi); 737 ♂ 26-1-40 Setti-hālli (2,500'). *Biligirirangan Hills*: ♂ 21-12-32, M11(H) ♂ 8-5-34 (5,000'—Honnametti); M112(H) ♂? juv. 24-5-34 (4,000'—Edbūthi); M4(G) ♂ 10-10-34, 31-33 ♂♀♀ 9-11-39, 42-44 ♀♀♀ 10-11-39 (4,000'—Bellāji).

Elsewhere noted: Āgumbē (on denuded grassy patch—old village site; deciduous facies of evergreen biotope).

[Measurements:

	Bill	Wing	Tail
12 ♂♂	16-18	92-105	49-57.5 mm.
5 ♀♀	16-17	91-94	46-52 mm.
1 ♂? juv.	—	90.5	48.5 mm.—H. W.]

Resident. Fairly common. Met with in small parties and loose scattered flocks of up to 30 birds or so, on grass-covered hill slopes with outcrops of sheet rock. Also in the low country about cultivation in forest clearings. Its call notes (song) are rather like those of *Galerida cristata*. Almost all the Survey specimens had enlarged gonads (testes 4×3 to 6×4 mm.; ovaries granular) and the pair 255 and 256 (testes 7×5 ; largest ovum 3 mm.) were certainly ready to breed (4 December).

Ammomanes phœnicura phœnicura (Franklin). The Indian Rufous-tailed Finch-Lark.

Specimens collected: 311 ♂ 10-12-39 Māndya (2,200'); 410 ♂, 411 ♀ 22-12-39 Mākliḍrūg (2,800'); 544 ♀, 545 ♂ 6-1-40 Marikānivē (2,500').

Elsewhere noted: Kolār Gold Fields.

[Measurements:

	Bill	Wing	Tail
3 ♂♂	16.5-18	106.5-111.5	60.5-63.5 mm.
2 ♀♀	15.5-16	102.5-103.5	58-59 mm.—H. W.]

Resident. Not common. Confined to deciduous biotope. Typical habitat: Open, stony, sparsely scrubbed country—almost semi desert—and about ploughed and fallow fields.

At Māndya, originally country such as its typical habitat but now transformed into a fertile cultivated tract due to irrigation by the Irwin Canal system, this lark still persists as a relic of pre-canal days.

All the specimens showed gonadal maturity. In No. 545 (6 January) the testes measured 7×4 mm., and the ovary of its pair (544) was conspicuously granular. The birds were obviously preparing to breed.

Eremopteryx grisea grisea (Scopoli). The Ashy-crowned Finch-Lark.

Specimens collected: 224 ♂, 225 ♀ 1-12-39 Antarsāntē (2,500'); 413 ♀ 414 ♂ 22-12-39 Mākliḍrūg (2,800').

Elsewhere noted: Hangala village (near Bāndipūr), Begūr, Hiriṃyūr, Kolār Gold Fields.

[Measurements:

	Bill	Wing	Tail
2 ♂♂	11-12	77-77.5	42-43.5 mm.
2 ♀♀	11-12	74.5-78.5	41-43.5 mm.—H. W.]

Resident. Fairly common. Confined to deciduous biotope. Typical habitat: Open, dry, sparsely scrubbed country and fallow land. Usually seen in pairs or small scattered parties.

Gonads of both the pairs were mature. Testes 6×4 and 5×4 mm.; ovaries granular with largest follicles over 2 mm.

Major Phythian-Adams has c/2 and c/2 taken near Gūndlūpet, 11-9-27 and 3-3-28.

Zosterops paiebroza occidentis Ticehurst. The White-eye.

Specimens collected: 531 ♂ 2-1-40 Nāmadachilumē (3,000'); 845 ♀ 7-2-40 Agūmbē (2,500'). *Biligirirangan Hills*: 27 ♀, 28 ♂ 9-11-39, M113(H) ♂ 25-5-34 (4,000'—Edbūthi); ♀ 30-12-32, M50-51(H) ♀♀ 12-5-34, M31(G) ♀ 29-9-34 (5,000'—Honnametti); M88(H) ♂ 18-5-34, (4,000'—Anāribetta); M41(G) ♂ 27-10-34 (4,000'—Bellāji).

Elsewhere noted: Bandipūr, Saklēshpūr, Bābābūdan Hills (Kemmangūndi 4,500'; Jāgar Valley 2,500'), Jōg.

[Nos. 845 and 531 certainly cannot be distinguished from *Z. p. occidentis* either in colour or size. They measure

	Bill	Wing	Tail
1 ♂	12.5	57	39 mm.
1 ♀	13	55	37 mm.

The remainder of this series—all from the *Biligirirangan*s—can only be considered as intermediates having the colour of *occidentis* on the upper parts but being rather darker on the breast and flanks below, i.e. there resembling *nilgiriensis*.

Measurements:

	Bill	Wing	Tail
5 ♂♂	13	56.5-57.5	39-41.5 mm.
6 ♀♀	12-13	55-57	37-41 mm.

All are at once distinguished by their larger beaks from *sālimalii* of the Eastern Ghāts.—H. W.]

Resident. Common. In small parties and sometimes flocks of over 50 among the foliage and blossoms of trees in both evergreen and deciduous biotopes. *Loranthus* flowers and the white brush-like blooms of *Eucalyptus* (*robusta*?), wherever growing, invariably attract the birds.

The 4 Survey specimens (9 Novem. to 7 Feb.) had fairly well developed gonads. On the latter date, the largest ovum of No. 845 was over 4 mm. in diameter and her distended oviduct indicated that eggs had been laid.

Cinnyris lotenia (Linn.) Loten's Sunbird.

Specimens collected: *Biligirirangan Hills*: 22 ♂ 8-11-39 (4,000'—Bedagūli); M87(H) ♂ juv. 18-5-34 (4,000'—Anāribetta); M22(G) ♀ 17-10-34 (4,000'—Edbūthi); M33(G) ♂, M36(G) ♂ 22-9-34 (2,000'—Satyamangala).

[Measurements:

	Bill	Wing	Tail
3 ♂♂ ad.	27-29	56-60.5	36-40 mm.
1 ♀ ad.	26	54	32.5 mm.
1 ♂ juv.	—	53.5	31 mm.—H. W.]

Not uncommon in wooded country, principally in the intermediate zone, but completely replaced by *C. minima* above ca. 4,000' elevation.

Cinnyris asiatica asiatica (Lath.). The Indian Purple Sunbird.

Specimens collected: 86 ♂ 17-11-39, 95 ♂ juv. 18-11-39 Bandipūr (3,300'); 426 ♂ 23-12-39 Māklidrūg (2,800'); 774 ♂ 30-1-40 Settihālli (2,500'). *Biligirirangan Hills*: M68(G) ♂ 21-7-34, M75(G) ♂ 22-7-34 (3,000'—Udahatti, Eastern base).

Elsewhere noted: Nāmadachilumē, Marikānivē, Kolār Gold Fields.

[Measurements:

	Bill	Wing	Tail
5 ♂♂ ad.	20-22	55.5-59	33-35 mm.
1 ♂ juv.	—	56.5	33 mm.

The juvenile has the upper parts darker than the few other juveniles I have seen of the typical race.—H. W.]

Resident. Common. Confined to deciduous biotope where it affects secondary jungle, wooded cultivated country, gardens and compounds.

No. 774 (30 January) in full breeding dress, had testes 6×4 mm.

Cinnyris minima Sykes. The Small Sunbird.

Specimens collected: 740 ♂ 26-1-40 Settihalli (2,500'); Biligirirangan Hills: 51 ♂ 11-11-39, M50(H) ♂ 10-4-34 (4,450'—Dodsampagi); 56-♂, 57 ♀ 11-11-39 (5,000-5,500'—Honnametti); M86(H) o? juv. 18-5-34 (4,000'—Anaribetta) and 3 others (M) without particulars (2 juveniles, 1 adult).

Elsewhere noted: Saklëshpür, Bābābūdan Hills (Kemangūndi 4,500'; Jāgar valley 2,500'), Āgūmbē, Jōg.

[Measurements:

	Bill	Wing	Tail
5 ♂ ♂	14.5-17	48-49.5	27.5-31 mm.
1 ♀	14.5	46	26
3 ♂ ♂ juv.	—	46.5-49	26 mm.—H.W.]

Resident. Common. Confined to evergreen biotope and found up to the highest sholas.

Cinnyris zeylonica (Linn). The Purple-rumped Sunbird.

Specimens collected: 141 ♂ 22-11-39 Bandipür (Hangala ca. 2,800'); 219 ♀ 11-12-39 Antarsāntē (2,500'); 416 ♂ 22-12-39 Mākḍirūg (2,800').

Elsewhere noted: Saklëshpür (in deciduous facies).

[Measurements:

	Bill	Wing	Tail
2 ♂ ♂	18	58	35-36.5 mm.
1 ♀	18	56	35 mm.—H. W.]

Resident. Fairly common. Confined to deciduous biotope, mostly on the plateau. Affects scrub and light secondary jungle, also dry cultivated country with tamarind and babool trees, and cactus hedges and brakes.

The testes of both the ♂ specimens were enlarged to 5×3 and 3×2 mm. respectively.

Arachnothera longirostra longirostra (Latham). The Little Spider Hunter.

Specimens collected: 655 ♂ 17-1-40 Saklëshpür (3,000'); 742 ♂, 743 ♀ 26-1-40 Settihalli (2,500').

Elsewhere not noted.

[Measurements:

	Bill	Wing	Tail
2 ♂ ♂	34-37	66.5-67.5	40.5-41.5 mm.
1 ♀	32	59.5	38.5 mm.—H. W.]

Resident. Confined to evergreen biotope. Partial to the moist-inter belt. Blossoming *Loranthus* clumps within its usual habitat are regularly visited for the nectar, and I have repeatedly found pollen adhering to the bills of specimens.

The gonads of all the three specimens were mature and the birds were obviously ready to breed shortly (testes 6×5 and 7×4 mm.; ovary conspicuously granular).

Dicaeum concolor concolor Jerdon. The Nilgiri Flowerpecker.

Specimens collected: Biligirirangan Hills: ♀ 22-12-32 (4,000'—Edbūthi); M2(G) n? 9-10-34, M6-7(H) ♂ ♀ 7-5-34 (5,000'—Honnametti).

Not met with by the Survey.

[Measurements:

	Bill	Wing	Tail
1 ♂	13	52	— mm.
2 ♀ ♀	13-13.5	49-51.5	25 mm.—H. W.]

Possibly overlooked in the other Mysore hills where, as in the Biligiris, it doubtless occurs between 4,000' and 5,000' elevation.

Dicaeum erythrorhynchos erythrorhynchos (Latham). Tickell's Flowerpecker.

Specimens collected: 102 ♂ 18-11-39 Bandipür (3,300'); 274 ♀ 5-12-39 Antarsāntē (2,500'); 521 ♂ 1-1-40 Nāmadachilumē (3,000'); Biligirirangan Hills:

M74(G) ♂ 22-7-34, M78(G) ♀ 23-7-34 (3,000'—Ūdahatti, Eastern (deciduous) base).

Elsewhere noted : Shimsha, Sivāsamūdrām, Kolār Gold Fields.

[Measurements :

	Bill	Wing	Tail
3 ♂ ♂	11-12.5	50-52	24-27 mm.
2 ♀ ♀	12	48-50	23-25 mm.—H. W.]

Resident. Confined to deciduous biotope, chiefly in the low country (plateau). It affects secondary jungle, forest plantations and groves of trees and is narrowly symbiotic with the tree-parasites *Loranthus* and *Viscum* of which it is undoubtedly the most important disseminator.

Piprisoma agile agile (Tickell). The Thick-billed Flowerpecker.

Specimen collected : 773 ♂ 30-1-40 Settihālli (2,500').

Elsewhere not noted.

[Measurements : 1 ♂ Bill 10, Wing 65, Tail 33 mm.—H. W.]

Resident. Rare. Settihālli lies in the intermediate zone.

This Flowerpecker also feeds very extensively on *Loranthus* and *Viscum* berries and is largely responsible for the dissemination of their seeds.

Pitta brachyura (Linn.). The Indian Pitta.

Specimens collected : 332 ♂ 13-12-39 Shimsha (2,500'); 618 ♂, 619 ♂. 14-1-40, 636 ♂ 15-1-40 Saklēshpūr (3,000').

Elsewhere noted : Nāmadachilumē, Bāndipūr, Marikānivē.

[Measurements : 4 ♂ ♂ Bill 22-25.5, Wing 106-110, Tail 37-40 mm.—H. W.]

Status uncertain. Not uncommon in deciduous biotope in the low or plateau country. Affects scrub and secondary jungle and is fond of clearings overgrown with *Lantana* thickets.

Picus xanthopygæus (Gray). The Little Scaly-bellied Green Woodpecker.

Specimens collected : 103 ♂ 18-11-39 Bāndipūr (3,300'); Biligirirangan Hills : M46(G) ♀ 24-9-34 (2,000'—Satyamangala); M62(G) ♂ 20-7-34, M34(G) ♀ 14-7-34 (3,000'—Ūdahatti, Eastern base (deciduous)).

Elsewhere not noted.

[Measurements :

	Bill	Wing	Tail
2 ♂ ♂	32-34.5	123.5-132	82-86 mm.
2 ♀ ♀	31-31.5	125.5-126	78-81.5 mm.—H. W.]

Resident. Not common. Confined to deciduous biotope. Affects secondary jungle and forest plantations.

Picus chlorolophus chlorigaster Jerdon. The Small Indian Yellow-naped Woodpecker.

Specimens collected : 239 ♂, 240 ♀, 2-12-39 Manchgowdanhalli (2,500'); 277 ♀ 5-12-39 Antarsāntē (2,500'); 616 ♂ 13-1-40 Saklēshpūr (3,000').

[Measurements :

	Bill	Wing	Tail
2 ♂ ♂	27.5-28	124-127	81-83 mm.
2 ♀ ♀	26-27.5	125-128	83-84 mm.—H. W.]

Resident. Found principally in the intermediate zone from fringe to fringe, usually in pairs. Preferential habitat : Teak and bamboo forest.

Stomachs of 2 specimens contained larvae of *Hapalia machaeralis* (Pyralidae) and larvae, pupae and adults of *Cremastogaster* ants (Formicidae). The former is an important defoliator of Teak (*Tectona grandis*) and causes enormous damage in teak plantations.

The gonads of all except No. 239 were mature, and the birds were evidently about to breed (testes 11×7; largest ova 2 mm.).

Dryobates maharattensis maharattensis (Latham). The Southern Yellow-fronted Pied Woodpecker.

Specimens collected: 516 ♂, 517 ♀ 1-1-40, 524 ♀ 2-1-40 Nāmadachilumē (3,000'); Biligirirangan Hills: ♀ 29-12-32, ♀ 31-12-32 (4,000'—Dodsampagi); M14(G) ♀ 9-7-34, M48(G) ♀ 18-7-34, also 1 ♀ juv. (3,000'—Udahatti, E. base).

Elsewhere noted: Bandipūr.

[Measurements:

	Bill	Wing	Tail
1 ♂	24.5	101	58 mm.
6 ♀ ♀	21-23.5	98.5-103	54-61.5 mm.
1 ♀ juv.	—	99	58 mm.—H. W.]

Resident. Not uncommon. Confined to deciduous biotope. Affects secondary jungle entering the fringe of the dry-inter belt. Met with singly or in pairs, frequently as a component of the mixed hunting parties of insectivorous birds.

Gonads of the pair of 1 January were maturing: testes 5×3 mm.; ovary granular.

Dryobates hardwickii hardwickii (Jerdon). The South Indian Pigmy Woodpecker.

Specimens collected: 77 ♀ 15-11-39; 88 ♂ 17-11-39 Bandipūr (3,300'); 204 ♀ 30-11-39 Antarsantē (2,500'); 351 ♀ 15-12-39 Devarbetta Hills (3,200'). Biligirirangan Hills: [♂] 31-12-32 (4,000'—Dodsampagi); M53(H) ♂ 13-4-34 (4,000'—Bellāji); M16(G) ♀ 19-9-34 (2,000'—Satyamangala); M49(G) ♀ 18-7-34, M64(G) ♂ 20-7-34 (3,000'—Udahatti, E. base).

[Measurements:

	Bill	Wing	Tail
4 ♂ ♂	14.5-15	73-78	33-38 mm.
5 ♀ ♀	14-15.5	75-79	33.5-37.5 mm.

These birds are very distinct from the good specimens of *D. h. cinereigula* obtained by the Travancore Survey.—H. W.]

Resident. Not uncommon. Confined to deciduous biotope. Affects secondary and thin tree and bush jungle. Usually pairs in the mixed hunting parties.

Micropternus brachyurus jerdoni (Malherbe). The Rufous Woodpecker.

Specimens collected: 165 ♀, 166 ♂ 24-11-39 Bandipūr (3,300'); 182 ♀ 28-11-39, 248 ♂ 3-12-39 Antarsantē (Manchgowdanhalli 2,500'); 784-786 ♀ ♂ ♀ 31-1-40 Setthihalli (2,500').

Elsewhere noted: Bedagūli (Biligiris), Maddūr (near Gündlūpet).

[Measurements:

	Bill	Wing	Tail
3 ♂ ♂	27-30	124-134	61-65 mm.
4 ♀ ♀	27-530	125-127.5	60-64.5 mm.

These birds all exhibit the slightly larger range of measurements which one finds in this woodpecker in southern India north of the Nilgiris as explained in the Eastern Ghāts Survey (*J.B.N.H.S.*, xxxvii, p. 37) but I have so far hardly considered it worthwhile separating South Indian birds into two races. All birds have the chocolate and white squamation on the throat.—H. W.]

Resident. Fairly common. Confined to deciduous biotope. Affects secondary jungle, especially bamboo facies, and teak and other forest plantations. Stomachs contained 2 species of black ants (*Cremastogaster*) exclusively.

The gonads of specimens collected on 31 January (Setthihalli) were maturing: testes 4×3 mm.; ovaries granular.

Brachypternus benghalensis puncticollis (Malherbe). The Southern Golden-backed Woodpecker.

Specimens collected: 123 ♂ 20-11-39 Bandipūr (3,300'); 394 ♂ 20-12-39, 448 ♀ 26-12-39 Dodballapūr (2,900'); 613 ♀ 13-1-40 Saklēshpūr (3,000'). Biligirirangan Hills: 21 ♂ 8-11-39 (4,000'—Bedagūli); M47(G) ♂ 17-7-34, M49? (G) ♀ 23-7-34 (3,000' Udahatti, Eastern base).

Elsewhere noted: Antarsantē, Manchgowdanhalli, Maddūr (near Gündlūpet), Setthihalli.

[Measurements:

	Bill	Wing	Tail
4 ♂♂	39-41	143-146	84-88.5 mm.
3 ♀♀	37-39	140.5-145	83-88.5 mm.

The 2 Udahatti birds seem to show traces of intergrading with *B. b. tch-minae* of Travancore.—H. W.]

Resident. Common. Confined to deciduous biotope, occasionally entering the dry-inter belt. Affects lightly wooded country, gardens and compounds, and groves of trees about cultivation. The stomach of a specimen, in addition to remains of large black ants (*Camponotus*) and grubs, contained 3 entire 'kadāvē' berries (*Stephegyne parvifolia*?).

Dinopium javanense malabaricum Whistler. The Malabar Golden-backed Three-toed Woodpecker.

Specimens collected: 614 ♂ 13-1-40 Saklēshpūr (3,000'); 690 ♂ 20-1-40 Jāgar Valley (2,500'—Bābābūdans).

Elsewhere noted: Settiāhāli.

[Measurements:

	Bill	Wing	Tail
2 ♂♂	31.5	141-142	92-95 mm.—H. W.]

Resident. Common. More or less confined to the intermediate zone, usually to the evergreen portions of it.

Chrysocolaptes festivus (Boddaert). The Black-backed Woodpecker.

Specimens collected: 447 ♂ 26-12-39 Dodballapūr (2,900'); 508 ♀ 29-12-39 Thōndēbhāvi (2,500').

Elsewhere not noted.

[Measurements:

	Bill	Wing	Tail
1 ♂	54	151	80 mm.
1 ♀	52.5	155	86 mm.—H. W.]

Resident. Met with in dry open deciduous country about cultivation. Testes of ♂ 7×5 mm.; ovary of ♀ granular.

Chrysocolaptes guttacristatus chersonesus Kloss. Malherbe's Golden-backed Woodpecker.

Specimens collected: 763 ♂, 764 ♀ 29-1-40, 780 ♂ 30-1-40, 811 ♂, 812 ♀ 2-2-40 Settiāhāli (2,500'); 868 ♂ 12-2-40 Jōg (2,000'). *Biligirirangan Hills*: M14(H) ♂, M30(H) ♀ 1-3-34 (4,5,000'—Honnametti); M31(H) ♀ 4-3-34 (4,000'—Dodsampagi); M20(H) ♀ 9-5-34, M106(H) ♀ 23-5-34 (4,000'—Bellāji).

Elsewhere noted: Āgūmbē.

[Measurements:

	Bill	Wing	Tail
5 ♂♂	41.5-51.5	149.5-155.5	77-86 mm.
5 ♀♀	40.5-48	151-155	80-85 mm.—H. W.]

Resident. Common. Confined to evergreen biotope, particularly to the moist-inter belt.

Gonads of all the Survey specimens were quiescent.

Hemicircus canente cordatus Jerdon. The Malabar Heart-spotted Woodpecker.

Specimens collected: 778 ♂ 30-1-40, 815 ♀ 2-2-40 Settiāhāli (2,500').

Elsewhere noted: Jāgar Valley (Bābābūdans, 2,500'); Jōg.

[Measurements:

	Bill	Wing	Tail
1 ♂	22	94	32 mm.
1 ♀	19	91	32 mm.—H. W.]

Resident. Not uncommon. Typical habitat: intermediate zone, particularly the bamboo facies of this. Also partial to the neighbourhood of coffee plantations up to about 3,500' elevation.

Gonads of the specimens were maturing. Testes 4×3 mm.; ovary granular.

Macropicus javensis hodgsoni (Jerdon). The Malabar Great Black Woodpecker.

Specimens collected: 692 ♀ 20-1-40 Jāgar Valley (2,500'—Bābābūdan Hills);
746 ♀ 27-1-40 Settihālli (2,500').
Elsewhere noted: Āgūmbē, Jōg.

[Measurements :

	Bill	Wing	Tail
1 ♀	58	217	160 mm.

The juvenile ♀ (No. 692) differs from the adult ♀ merely in having the black feathers of the crown lightly tipped with crimson. I do not see why this bird should not be treated as a race of *Dryopicus martius* of Europe.

—H. W.]

Resident. Not uncommon. Confined to evergreen biotope. Usually met with in separated pairs. Its favourite habitat coincides with that of *Chrysocolaptes guttacristatus*.

Besides the metallic monosyllabic *chank*, uttered every 2 or 3 seconds three or four times in succession, it has a harsh short 'laugh' of 3 or 4 seconds' duration rather like that of the Malabar Grey Hornbill.

No. 746 (27 February) with some ovarian follicles 3 mm. in diameter was ready to breed. F. N. Betts informed me that he had found a nest with a clutch of 4 eggs in the first week of January near Somwārpēt in Coorg (a few miles across the Mysore border from Saklēshpūr or Periyapatna).

Vivia innominatus avunculorum (Hartert). The Nilgiri Speckled Piculet.

Specimen collected: 691 ♀ 20-1-40 Jāgar Valley (2,500'—Bābābūdan Hills).
Elsewhere noted: Settihālli.

[Measurements :

	Bill	Wing	Tail
1 ♀	11	59	34 mm.

Here, as in the Eastern Ghāts Survey (*J.B.N.H.S.*, xxxvii, 297) I only use the name *avunculorum* in deference to the emphatically stated opinion of Hartert (*Vög. Pal. Fauna*, vol. iii, p. 937) who had presumably seen more specimens than I have had access to. I cannot personally separate the 'specimen from *malayorum*.—H. W.]

Resident. Perhaps less common than at first sight it appears to be since it may be quite easily overlooked. Confined to evergreen biotope. Its typical habitat appears to be identical with those of *Macropicus* and *Chrys. guttacristatus*, but with a greater sprinkling of bamboo and smaller trees.

This little woodpecker is usually seen in pairs as members of the localised hunting parties comprising *Chaptia*, *Tephrodornis sylvicola*, *Machlolophus*, *Hemicircus*, *Culicicapa*, *Phylloscopus occipitalis* and *trochiloides*, *Sitta frontalis* and other small insectivorous birds. This list ought to bring up a complete picture of its typical habitat to one who is acquainted with the field ornithology of the evergreen biotope of South-West India. The Piculets are easily lost amongst the more numerous *Phylloscopi* and are apt to be passed over in the restless activity that prevails. Only a careful scrutiny of the individual members of such an association will show them up as rather more broad shouldered and of the typical 'triangular' woodpecker shape. In general appearance, colouration and in some of its habits also, it resembles the Thick-billed Flowerpecker (*Piprisoma*). Its behaviour and actions are likewise strongly reminiscent of the Pigmy Woodpecker (*Dryobates hardwickii*). It creeps round the thin horizontal leafy end twigs of moderate sized trees in search of insects, frequently clinging upside down and working round them in the style of a nuthatch. I did not hear it uttering any note.

The specimen was breeding. It had a soft ovarian egg measuring 7 mm. in diameter. The greatly distended oviduct indicated that eggs had been laid.

lynx torquilla torquilla Linn. The European Wryneck.

Specimen collected: 362 ♂ 17-12-39 Sātūr (2,500'—near Pālār River).
Elsewhere not noted.

[Measurements: 1 ♂ Bill 17, Wing 92, Tail 67.5 mm.

This is the most southerly record of the Wryneck in India since Jerdon's old statement that he obtained it at Nellore and Madras.—H. W.]

Winter visitor. Rare. The specimen—the only met with in Mysore—was shot in a scrub-covered ravine among low hummocks and cultivation. Deciduous biotope.

Therecoryx zeylanicus subsp. The Large Green Barbet.

Specimen collected: *Biligirirangans*: M24(G) 20-9-34 (2,000'—Satyamangala). Not met with elsewhere in Mysore territory.

Therecoryx viridis (Bodd.). The Small Green Barbet.

Specimens collected: 66 ♀ 15-11-39, 92 ♀ 17-11-39 Bandipūr (3,300'); 486 ♂, 487 ♀ 28-12-39 Dodballapūr (2,900'); *Biligirirangan Hills*: M2(H) ♀ 27-2-34, M8(H) ♀, M10(H) ♂ 23-2-34, M9(H) ♂ 8-5-34, M21(H) ♀ 9-5-34, M32(G) ♀ 20-10-34 (4,500-5,000'—Honnametti).

Elsewhere noted: Bedagūli (Biligiris), Karāpūr, Nāmāchilumē, Jāgar Valley (Bābābūdans), Āgumbē.

[Measurements:

	Bill	Wing	Tail
3 ♂♂	24-26	103-110	65-68.5 mm.
7 ♀♀	24-28.5	101.5-113	60-70 mm.—H. W.]

Resident. Common. Affects both evergreen and deciduous biotopes, but is most partial to the intermediate zone. It is invariably present on the various *Fici* in fruit. Does considerable damage to coffee 'cherries' and is for that reason a minor pest in coffee plantations.

The specimens of 28 December had mature gonads and were evidently due to breed shortly. Testes 7×4 mm.; ovary granular.

Xantholœma hæmacephala indica (Lath.). The Crimson-breasted Barbet.

Specimens collected: 156 ♂ 24-11-39, 170 ♀ 25-11-39 Bandipūr (3,300'); 442 ♀ 24-12-39, 473 ♂ 27-12-39 Dodballapūr (2,900'); *Biligirirangan Hills*: M33(G) ♂ 14-7-34, M51(G) ♀ 18-7-34 (3,000'—Ūdahatti); M50(G) ♂ 25-9-34 (2,000'—Satyamangala).

Elsewhere noted: Karāpūr, Chāmūndi Hill (3,200'—Mysore City environs), Nāmāchilumē, Kolār Gold Fields.

[Measurements:

	Bill	Wing	Tail
2 ♂♂	18-18.5	81.5-84	33.5-36 mm.
2 ♀♀	18-19	82-83	34-36.5 mm.

The 3 Biligiri birds are in moult so not measured.—H. W.]

Resident. Common. Confined to deciduous biotope. Affects wooded country and groves of trees about towns and villages, and cultivation. Invariably present on the various figs in fruit.

Gonads of the specimens of 24 and 27 December were mature (testes 10×6 mm.; ovary granular). On 3 December a bird was observed (Karāpūr) entering its nest hole in the snag of a branch ca. 15 ft. up.

Xantholœma rubricapilla malabarica (Blyth). The Crimson-throated Barbet.

Specimens collected: 610 ♂ 13-1-40, 640 ♂ 15-1-40 Saklëshpūr (3,000').

Elsewhere noted: Jāgar Valley (Bābābūdān Hills 2,500').

[Measurements: 2 ♂♂ Bill 16-17, Wing 82-83.5, Tail 36-36.5 mm.—H. W.]

Resident. Confined to evergreen biotope where it seems to be the ecological counterpart of the Crimson-breasted Barbet. Also occurs freely in the moist-inter belt.

The specimens were either breeding or ready to breed: testes 10×8 and 7×5 respectively. No. 610 was one of a pair with a nest hole in a branch ca. 20 ft. up. The pair attacked and drove off a pair of Mahratta woodpeckers from its proximity.

(To be continued)

CIRCUMVENTING THE MAHSEER AND OTHER SPORTING FISH IN INDIA AND BURMA.

BY

A. ST. J. MACDONALD.

PART III

(Continued from Vol. xliii, No. 3 (1942), p. 361).

(With 1 plate and 18 text-figures).

TACKLE FOR MAHSEER.

I. HEAVY MAHSEER TACKLE—*Rods* (1), *Reels* (2), *Lines* (3), *Splicing Line* (4), *Traces* (5), *Swivels* (6), *Connecting Links* (7), *Attaching Trace to Line* (8), *Weights* (9), *Lures* (10), *Mounts* (11), *Split Rings* (12), *Plugs* (13), *Spinners* (14), *Mounting Dead Bait* (15), *Legering* (16), *Weighing Giant Fish* (17), *Gaff or Spear* (18), *Baiting Needles* (19), *Disgorger* (20), *Repairs to Rod* (21), *Line Drier* (22).

II. TACKLE FOR SMALLER FISH—*Medium Mahseer Fishing* (23), *Rods* (24), *Steel Rods versus Split Cane*, *Greenheart and Ringal* (25), *Thread Line Rods* (26), *Double-handed Casting Rods* (27), *Solid Cane or Ringal Rods* (28), *Double-handed Fly Rods* (29), *Rod Fittings* (30), *Reels American* (31), *English Nottingham Reels* (32), *Stationary Drum Reels* (33), *Casting Line* (34), *Thread Line* (35), *Traces* (36), *Lures*, *Plug Spoons*, *Dead Bait* (37).

III. FLY SPOON AND SINGLE-HANDED FLY ROD—*The Rod* (38), *Reels* (39), *Lines* (40), *Traces* (41), *Treatment of Gut and how to tie Traces* (42), *How to tie a cast* (43), *Knots for Traces* (44), *Knots for attaching gut to swivels* (45), *Lures* (46), *List of Tackle Dealers* (47).

A chapter on tackle could fill a tome, were I to go into detail of past and present, and illustrate the outfit freely. This is quite unnecessary in view of the excellent Anglers' Guides now offered by the many tackle makers, and by dealers, both in this country and at home.

Get a well-illustrated catalogue from Hardy, Allcock, Farlow, Albert Smith or with whomever you deal, or better still out here from Mantons, the Army & Navy or Verona, and you will be equipped to study the various forms of baits, knots, etc.; besides which they have a number of instructive notes.

In the first instance 'Tackle for Mahseer' is an indeterminate Heading for this chapter, when it is considered that this fish offers sport from $\frac{1}{4}$ of a pound to 5 score or more, and that consequently tackle must be classified or grouped for 'Heavy', 'Medium', and 'Light' fishing; so I will subdivide this chapter into three parts.

I. HEAVY MAHSEER TACKLE.

By 'Heavy' I mean big water and looking for big fish, that is for fish 30 pounds upwards. This type of fishing is almost exclusively enjoyed in Burma and Assam, it is best done from a boat, as the

water is too big to command from the banks, and very often the best places are from islands in the river, or at large junctions. It is a type of fishing unto itself. To illustrate the type of fishing I am dealing with I will quote just two such days; one from Assam and one from Burma from 'The Angler's Hand Book' by Lacey.

Assam.—The river is called the Punateet, and runs out of the Khasia hills at Laour. To get to it, you have to branch off at Sonamgunge (on the Soormah) and go by boat to a village called Elamgao; here you can get Dingies and boatmen to take you up the gorge, where you must rough it in a grass hut. It is a beastly unhealthy place. Every time I go there all my servants are knocked over with fever. I got it once myself, but on that occasion I was there six weeks. Extract from my diary:—

November	19th	got nil, lost 4 fish.
"	20th	" 1, lbs. 19, lost 3.
"	21st	" 2, " 30, 36.
"	22nd	" 6, " 46, 31, 41, 25, 13, 12.
"	23rd	" 2, " 44, 30.
"	24th	" 2, " 24, 32.
"	25th	" nil, gave the good pools a rest, and tried some new water.
"	26th	" 3, " 18, 58, 55.
"	27th	" 3, " 29, 29, 62.
"	28th	" 8, " 16, 54, 20, 33, 7, 32, 33, 26.
"	29th	" 2, " 28, 26.
"	30th	" 1, " 28. Tried new water again.
December	1st	" 1, " 21.

Of course besides these fish I lost several, of which I kept no account. I got them all trolling with spoons 4 inches long'.

Burma.—By Lt.-Col. H. D. Keary.

'Lt.-Col. Taylor, 30th M. I., and myself, fishing from below the Rocks up to and about the Confluence, between the 1st and 21st April, 1903 took sixty-six fish, weighing a total of 696 lbs., the biggest fish being 45 lbs., second $43\frac{1}{2}$ lbs., and third 35 lbs.; many other large fish were hooked which broke us. I had on one fish for five hours, and had gone between two and three miles down stream with him, when he got me hung up in a sunken tree in sixty feet deep water, where it was impossible to clear the line, and I was obliged to break; what the weight of this fish was I don't know, but at the end of five hours' very hard fighting, with no rests or sulking, he appeared pretty nearly as lively as when first hooked; and to give some idea of what he might weigh, I may mention that the day before I killed a $43\frac{1}{2}$ lbs. fish, only very lightly hooked through the skin of the top of his head, in about $1\frac{1}{2}$ to 2 hours in exactly the same place as I first hooked this big one'.

I have, myself, fished the water mentioned by Keary, and taken in 28 fishing days, between the 11th April and 8th May 1928, fifty-three fish weighing $861\frac{1}{2}$ lbs., the five best being 75, 50, 48, 44 and 42 lbs. I also lost a fish, after playing it for over two hours.

Heavy Mahseer fishing is the privilege and good fortune of a select few; indeed, there must be few anglers in India, who would need more than five fingers to count the fish they have caught over 50 lbs. So that although it does not cover the general needs of the average angler, it is none the less the cream of sport with this fish, as a real big fish in big water is awe inspiring, and calls for extreme skill in handling and playing. The tackle must be good and strong, and the whole team of boatmen and angler, in full accord. Perhaps the greatest change during the last 18 years, has been in the methods, and tackle now generally in use.

1. *Rods*.—The old idea of long sixteen feet rods, heavy spoons, and baits, have given place (thanks to the advance made by tackle makers of strong light and pliable rods) to ten, and twelve feet rods, now almost universally used for the heaviest fish. Split cane, steel or green heart, are all popular; and for the man of limited means the ringal or bamboo rod made out here is strong enough to land any fish.

For this type of fishing we must take into account the heavy water to be fished, and with it, the large bait and weight that is necessary to work such water. Rapids may be twenty feet deep and two hundred yards across, and the volume of water will run the reel and bend the rod in two while the spoon is spinning, in fact a large spoon gives a strain of $2\frac{1}{2}$ to 3 lbs. while reeling in, in fast water (I tested this myself as a matter of interest). The back-aches after a day of this type of fishing, are a ready reminder of the strain to which both body and tackle are put. Another matter to bear in mind is that while playing a heavy fish you will have out between 100 and 200 yards of line for the first half hour or so, and it is extremely difficult in big water to control a fish with any but a strong and powerful rod; as an instance of this, just feel the stresses and strains your line and rod are put to when you get hung up in big water; this is what the fish is subject to when hooked and deep down in a rapid. So that a strongly built and stiff rod becomes pliable under these circumstances, but fish as light and with as pliable a rod as you can. I personally recommend the two-piece ringal or bamboo rod, with a spare top, and protected porcelain rings throughout, built by Verona or Mantons, as fitting all one's needs for this type of fishing. Verona will make up a rod to any specifications, and turn out an excellent job, and one can buy six of these rods for the price of one of Hardys, or the other better known makers. If one is to be stationed near big water, and price is of no consequence, then the other more expensive types can be purchased.

2. *Reels*.—A large reel, to take 300 yards of grade E (or 30 lbs. breaking strain) line is necessary, and here I strongly recommend the best reel you can afford, as it is in my opinion the most important part of the outfit; and any reel, except perhaps the sea fishing types, is called upon to do more than that for which it is built. I use Hardy's extra wide $4\frac{1}{2}$ in. silex, which is probably the most expensive of all casting reels, and frequently I have to go over the reel to tighten screws, nuts, etc., after running a big fish. I had an extra wide Decantelle reel, built specially for me by Hardy's

for this fishing, and found it stood up to the heavy work much better than the silex, and is excellent for casting a heavy weight though it does not 'sing', but, both hand pressure and braking can be applied if you indulge in this pernicious habit.

3. *Lines*.—Braided silk lines, 'Lignum Vitae' or Non-pareil, (both American), far surpass anything yet put on the market. They are strong, reasonably priced, and wear for three or four seasons if looked after, and dried daily after use. Dressed and enamelled lines want a great deal of care and attention out here, and either go tacky or rot, the enamelled lines get brittle and crack. This has been my experience. 'Lignum Vitae' and 'Non-pareil' are made in a number of grades, and I recommend a breaking strain of 25/30 pounds, for this type of fishing, depending on whether your reel can take 300 yards of line or not. This is most important.

Backing, for preference, should be line of flax or hemp, and slightly stronger than the braided line. If a twisted line is preferred, 'Donegal' Cutty Hunk is finer, relatively, than most other lines, for its strength, thus enabling you to get more line on to the reel. A rough calculation for line is to multiply the breaking strain by four, this gives the weight in pounds of the fish you should be able to capture ($30 \times 4 = 120$ lbs).

The weakest part of the line is at the knot, so avoid, if possible, making knots, by splicing a loop at the end of the line where it joins on at the trace as in fig. 1.

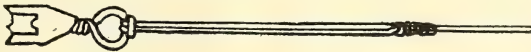


Fig. 1.

Line can usually be bought in 200 yards lengths, but if backing is to be attached never join them by a knot, but by a long splice, of not less than $2\frac{1}{2}$ inches, in the manner described here. This also applies to a broken line.

4. *Splicing Line*.—Pick the ends of the line, open carefully with a needle or other convenience, as in fig. 2 a, to one inch or more from the end, then flick in the manner of a whip, this opens up the silk threads. Then wax over and fork into two points as in (fig. 2 b) of diagram, close the forked ends into each other as in fig. 2 c of diagram and lash together with strong waxed silk (fig. 2 d) and dry.

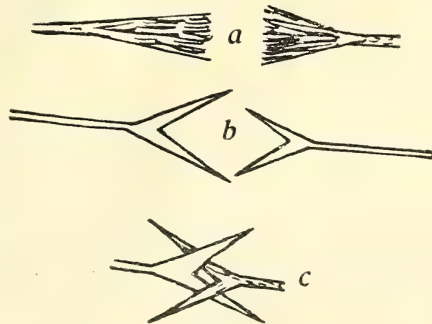


Fig. 2. a, b, c, d.

5. *Traces*.—H o r w o o d s Killin wire traces are the best I have used, and I can thoroughly recommend them as being the most reliable and the

least conspicuous in the water, and as by far the best wire for

traces on the market to-day. Use strong or medium gauge. If the wire kinks after the strain of playing a fish, it can quite easily be rectified by replacing it from a spool of fifty yards carried spare, which can be obtained for Rs. 3-4-0 from any tackle dealer.

Wire traces are made up in a couple of minutes with the aid of a pair of pliers and a spool of Killin wire. Cut away the old wire from the swivels and replace it with similar lengths from the spool. Care must be taken to twist both wires evenly round each other for three or four coils, then twist the short end around the main wire and cut as close as possible. This is best done by passing the short end through the eye of the swivel, bending it around and holding it where the wire crosses over, (fig. 3 a).

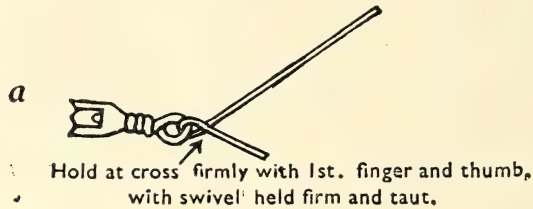


Fig. 3 a.

With the ends crossed and made to form an angle of approximately 45 degrees twist evenly with the swivel held taut and firm, repeat this for three or four turns, then twist the short end around the longer end and cut close (fig. 3 b).

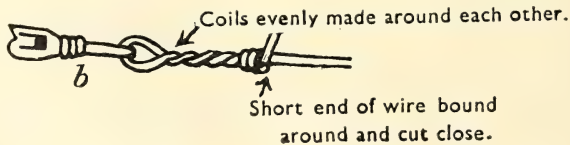


Fig. 3 b.

If the twist does not come evenly, cut away the bent wire and try again. If the long wire is twisted around the shorter end in the first coil or so, it is liable to break under strain, so be very careful to avoid this happening. If the shorter wire is bound around the longer of the two, without the even twist near the swivel, it is apt to draw down on to the swivel and pull open. A watchman's small vice together with pliers, will tend to quicker and better work.

6. *Swivels*.—Only use the best, as you can then use the smaller sizes, 6 or 8, for the heaviest fish. Spare swivels should be carried in a small bottle in oil, they keep like this indefinitely. Link swivels for this heavy type of fishing should be specially made and I strongly recommend the type I illustrate with the Myitkyina spoon, these were specially made by Hardys for me, and I have not had them fail me once. I give four types of American connecting links which are both hardy and strong to use, and which are obtainable from

most tackle dealers out here. (See fig. 4, 1 *a* and *b*, 2 *a* and *b*, 3 and 4).

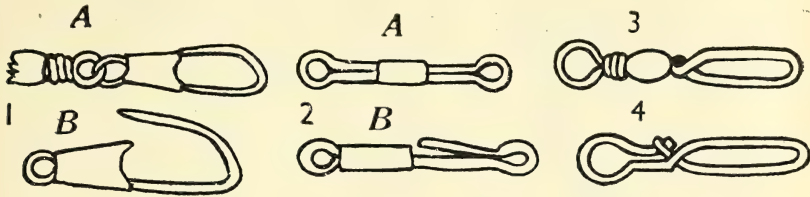


Fig. 4 A & B.

7. *Connecting Links*.—These make a good substitute if you are out of link swivels, though they are not, unfortunately, rounded off or pear-shaped like the attachment I have recommended above.

8. *Attaching Trace to Line*.—The best way to attach your trace is by a large loop spliced on the line, this can be passed through the eye of the swivel and over the bait then drawn tight, making a double loop on the eye of the swivel, apart from strengthening the join with the trace it also can take up any wear caused by the weight. (See diagram under 'Lines').

9. *Weights*.—For casting a heavy spoon and getting the full use from it, weights must be used, there are many handy shapes and sizes made, as reference to any fishing catalogue will show. 'Anti Kink', 'Barrel', 'Spiral', etc. If possible, never attach a weight permanently to your trace, this is the cause of more fish being lost than any other, as they invariably foul snags and rocks, while playing a fish, besides getting one hung up. Use only leads that can be attached in a temporary sense, to the trace by a strong piece of silk, which would snap if fouled and so lose the lead but release the line. A barrel-shaped lead with a hole right through to pass a silk thread for tying, is what I use and recommend. The spiral type is also good, so long as they are not securely fixed to the line (fig. 5 Barrel Lead).

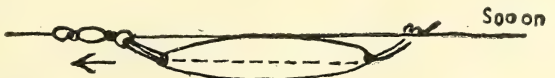


Fig. 5.

With a four-inch spoon in heavy water use a four-ounce lead and you may even require one heavier, though four ounces should be good and heavy enough for most water with a flat spoon. With the hog-backed spoon a much heavier weight is necessary, as it takes a greater hold of the water. When fishing for the big fellows search the bottom with your bait; and even though you lose tackle you will be rewarded in the end; for then only will you catch the 'Grandmothers'.

10. *Lures*.—Spoon has a distinct advantage in big water such as we are considering for this type of fishing. As I have explained elsewhere it has greater searching power than the other lures, plug,

dead bait, etc., in fact it is almost exclusively used in Burma for this type of fishing, and also in Assam.

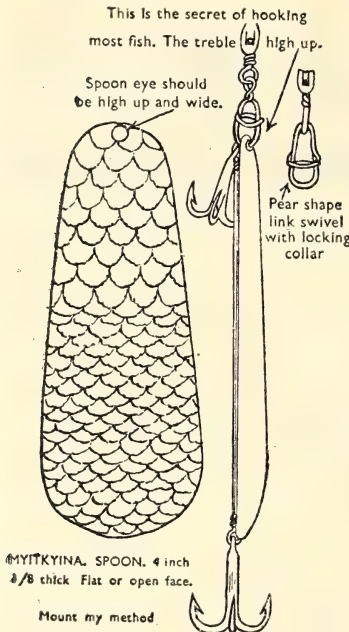


Fig. 6.

Spoons, like flies, have their fanciers, and it would be folly to eulogise at length on any one particular kind. I can only suggest that with certain localities we find some spoons better than others. This, more than fancy then, should be our chief study.

There are certain general principles to be kept, while fishing with spoon. The clearer the water the duller the spoon; the duller the water the brighter the spoon; likewise, the shallower the water the smaller the spoon; and deeper the water, bigger the spoon; the faster the run the flatter the spoon; (open faced and narrow). Then for trolling in a pool with slow water a hog-backed spoon is most suitable. The spoon is subjected to many combinations of colours, gilt and silver, copper and silver, all silver, all brass. The duller surface is usually the larger surface of the spoon, as made up by tackle makers. It is

a good plan to have a few of each in both sizes and shapes with the colours reversed. I myself, fancy the Myitkyina type of spoon, as it gets down deeper than most of the other types, and I believe a narrow spoon increases the chances of hooking a fish, as his mouth is able to close further than on the broad hog-backed type, the scale effect deeply cut into these spoons appears to attract fish more than the plain types. See fig. 6.

II. *Mounts*.—I am, myself, in favour of the flying mount with two trebles for large spoons (fig. 6).

A piece of galvanised wire the thickness of a stout spinning line made up to fit spoons of all sizes, in the following manner. Make a loop at either end of the wire, each containing a treble the tail hook to be larger than the top hook. Avoid using very large trebles as they are quite unnecessary. I would call size 1 in trebles large enough for any mount in the tail hook, and size 4 for the top hook. Use only the best, either Hardy's oval wire or Verona's treble brazed; these sizes are for spoons of 3 to 4 inches long. Carry spare mounts, and spoons separately in suitable boxes, these can then be threaded on to the pear-shaped link, (as recommended by me) in a few moments, when a change is necessary. The correct length of a flying mount is half the loop and treble clear from the bottom of the spoon (fig. 6).

I give this form of mounting as it is my own, and is not men-

tioned elsewhere; other forms are well illustrated in tackle books, and can easily be followed or copied to one's own particular fancy.

12. *Split Rings*.—For large Mahseer fishing I can only repeat what Thomas said in 1887, Lacey in 1905, and Skene Dhu in 1923, 'Don't trust them'. They are the cause of more temper and fish being lost than anything else.

Do not be tempted by them under any circumstances, or you will share the fate of many of us. Strike perhaps only one fish in the day, and then the split ring goes! I will never forget my own experience of seeing and stalking a monster fish, and after the care of every thing being in order, I was left nothing but the want to use all my Dockyard vocabulary on the maker who made that 'Split Ring'. We are guided by experience, and if you are wise you will take this advice. Use the link swivel or collar attachment, or attachment link, they are just as convenient and more reliable.

13. *Plugs*.—Plug has, in recent years, become very popular, and has been used with great success both in India and Burma. They are very attractive in appearance, and are most realistic in fast water. The jointed types are favoured in slow water, and the one-piece for fast water. The makers (American) mount them with three trebles as a rule, but the hooks are too flimsy for Mahseer, and must be replaced with any of the special trebles made for fishing in India. They are made in all sizes, and have one great advantage over spoon in that they are heavy enough to cast without a weight, if necessary, and by the aid of the inclined plane keep under water, and do not get hung up in shallow rapids anything like a spoon. They are offered in a variety of colours and shapes, and stand a lot of rough use.

14. *Spinners*.—Devon or any other types of spinners are attractive and take well in certain localities, but are expensive, when it is considered that they give very little advantage, if any, over the spoon or plug. A couple, however, are handy to have by one, to try out, if other lures fail.

The Crocodile, Archer, or any of the other many makes are all good for mounting dead bait in a hurry, but none are as effective as the double mount threaded through a dead bait, as dealt with in detail, further on in this chapter.

15. *Mounting Dead Bait*.—If fish are shy, take trouble over mounting your dead bait, and you will be rewarded. If, on the other hand, fish are well on the feed, a Crocodile or Archer Spinner will be quite effective. The method I use, which is by no means original, is I think the best for mounting a dead bait. When mounting dead bait, it should be borne in mind that the act of the current helps or retards the rate of spin. A current setting towards one's own bank will rotate a bait which has a right-handed spin, faster than one with a left-handed spin; and vice versa. For different types of water the pace has to be different; and as water on the near bank is often placid the faster spin, obtained as above, is desirable. Different types further need a different spin. If the pace of the spin is correct the bait is more likely to induce a fish to seize it. It is the pace that kills—the correct pace. All fins of a dead bait

should be cut off with a pair of scissors—except the anal fin. A bait whirling round with fins rigid in death, sets up too violent waves of disturbance in the water. If the bait rotates too slowly it will not be taken; as already said—the pace it is that kills.

My method requires a reel of silk, a wide eyed needle, trebles mounted on suitable lengths of wire, a baiting needle and an attachment link. I have a tin with an assortment of mounted trebles, of varying lengths, in my bag, as getting the correct length of wire to suit a dead bait, is important. I mount my hooks on twisted Killin wire, which I coat with solder or 'Tinol'. These last indefinitely and are easy to mount, and do not break up the bait when drawn through from the vent. The method of mounting is quite simple and is done as follows. Get a suitable size of dead bait (4 to 6 inches is the best) and suit two lengths of wire with the mounted hooks, to the fish; see fig. 7a and b.

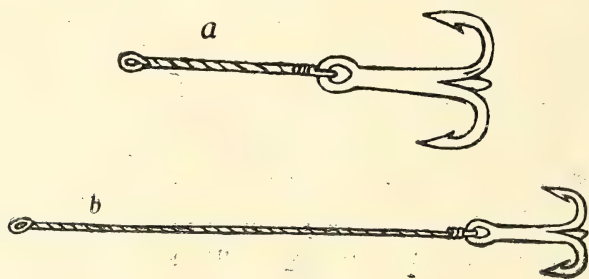


Fig. 7 a & b.

'a' should be just long enough to pass from the mouth to behind the gill, and is passed through the gill out through the mouth and threaded on to Attachment Link on Trace, as shown in fig. 7 c.

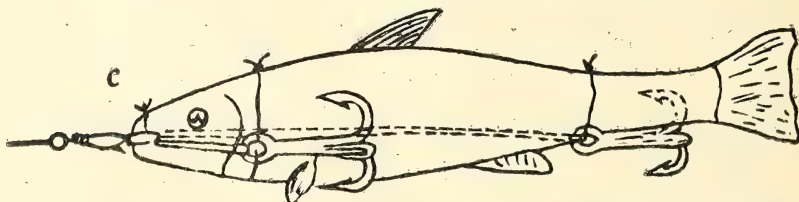


Fig. 7 c.

'b' should be threaded to a baiting needle, and run up through the vent and body to the mouth of the fish, the loop then threaded on to the Attachment Link. Pass a fine needle threaded with silk through the head from above, and through both wire loops on the Attachment Link, then through the lower jaw of the fish, run the silk through and then tie in front, and through the Attachment Link (fig. 7 c). One barb of the treble on wire 'a' should be fixed into the fish, the hook on wire 'b' should be fixed so as to give the dead bait a kink, depending on how much you want it to spin, both hooks should then be threaded in turn with silk or strong cotton either through the eye of the treble or over the

shank, and tied around the fish as shown in fig. 7c. The shorter the gill treble mount the better, and I prefer it to have the larger hook of the two, but this can be suited to one's own fancy.

A correspondent sends me the following:—

'I think the use of twisted Killin wire—which necessitates tinning or it will rust—would bother a novice. And as there are rustless steel wires on the market these are preferable. I have such steel wire—an American product—which is admirable for bait mounting. It takes solder readily (use broken spirits of salt). It is absolutely rustless; even under any salt water conditions.'

'The wire is readily manipulated with pliers. Being so thin it does not tear the vent: and its glitter does not matter. I use both this wire and rustless steel twisted wires—for dead bait—rather than Killin. It is made by Wickwire Spencer Steel Company, New York City and San Francisco. No. 7 breaking load 73 lbs. is suitable (this is finer than an ordinary spinning line). It is called Wissco Leaderwire, polished stainless steel. A heavy coil is obtainable for Sh. 5/6d. Obtainable from Verona, Dharamtalla Street, Calcutta.'

Another good mount, and one that I use in fast and heavy water is a Crocodile mount, but with a diving shield, much the same as plugs. And I have found this mount more effective than any of the more elaborately turned out ones as offered by tackle dealers. See fig. 8.

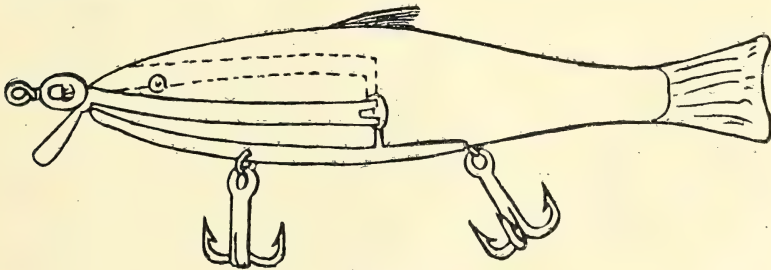


Fig. 8.

16. *Legering*.—Pass the line of the mount, doubled, through the eye of a single hook, give it three twists around the shank of

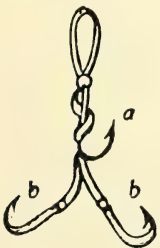


Fig. 9 A.

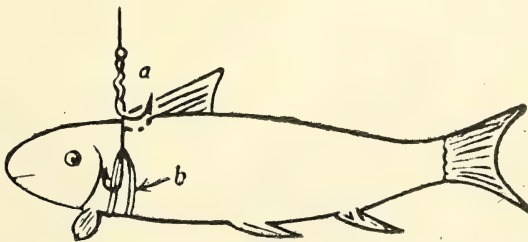


Fig. 9 B.

the hook, then fix to end of mount on either side of fish, a small single or treble hook. (See fig. 9A).

Fix hook *a* lightly through the skin of fish in front of dorsal fin, and the two hooks *b* one on either side. Pass a rubber band under fish and over both hooks to keep them flush with the side, and in position (fig. 9B).

Another method, is as in fig. 9C. *c* is fixed in the same manner as in fig. 9B, *a* with a single treble attached at end of mount, which lies loose by the side of the fish, with one barb of treble under and just free of the belly. Active fish may get the loose treble hung up on the bottom. The first method is preferable.

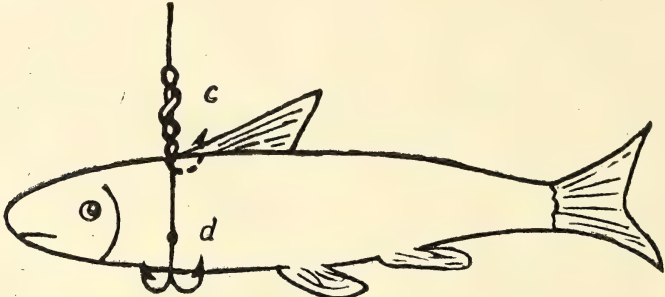


Fig. 9 c.

17. *Weighing Giant Fish*.—If your fish is heavier than your scale register, the correct weight can be arrived at as follows. That is if you have two spring balances. Tie your fish to a stick, and with a scale fixed at either end of the stick lift the fish and the sum of the readings on both scales will be the weight of the fish.

18. *Gaff or Spear*.—The Mahseer, for his size, has the largest scales of any other fish in India. On a large fish they are as big, and sometimes bigger than the palm of the hand, and are very tough. This makes the use of a gaff difficult, even to an expert. Moreover, the attendant one has with one on a fishing trip, is usually a passed master with a spear, and for this reason I advocate the use of a spear with a barb to it. It is more effective and more penetrating than a gaff, and is just as handy to carry.

19. *Baiting Needles*.—Keep half a dozen baiting needles with you, they are always handy, and are easily lost.

20. *Disgorger*.—Be human, and as soon as you have your fish shelved, knock him on the head and kill him. A disgorger can then be used, or a knife or scissors to cut out the hook. I have seldom found a disgorger necessary, but it is useful at times and is quite handy stuck into one's topee.

21. *Repairs to Rod*.—This would only apply to a green-heart or bamboo rod but is worth mentioning, should any one be fixed in the unfortunate position of only having the one top to a rod, and breaking it while on a trip in some remote part. Cut the two broken portions diagonally across so that they will fit (fig. 10 A.) Then with Durofix stick them together, and bind over neatly with strong silk. First of all fix the end of your silk along the splice or groove of the two sections. Continue past the splice and secure your end in the following manner. Before finishing the binding, and when

about eight coils remain, put a loop of silk at the end of the binding, as shown in fig. 10 C. Thread the loop with the end of the silk and draw through under the binding. Cut the end close and varnish over. If the break is where the wood is thin, towards the tip of the joint—the splice will be strengthened by a bird's quill—halved lengthways and bound beneath the silk wrapping.

22. *Line drier*.—This is a most important item in the outfit, as unless the line is dried daily after use, the lower coils of line on the drum will remain saturated and rot.

II. TACKLE FOR SMALLER FISH.

23. *Medium Mahseer Fishing*.—In part one I have dealt exclusively with the tackle for heavy work, and fitted my remarks to water where the exception is the small fish, and the rule the large fellows.

In this second part I will reverse the order, and consider the tackle which will suit the smaller size of fish.

That is, fish from 30 pounds or so downwards, but be up to taking the large ones should they come our way.

For choice, this type of fishing is preferable from the point of view of sport, as it produces more fish, and is as often as not in water where fly-spoon fishing can be combined, and affords rest from the otherwise hard labour that the heavy fishing entails. It is a general condition in most Northern India rivers.

Tackle will cover a wider range in variety and fancy for this type of fishing, as fish from 10 to 30 pounds can be taken in many ways if conditions permit.

The angler in the Doon, and in other suitable rivers, will perhaps use nothing but plug bait, with an American wide drum casting reel, and short steel or bamboo rod.

In still smaller rivers, or where conditions suit lighter tackle, the lover of the Wanless or thread line tackle will stake his wits against the largest fish.

Then there is the more orthodox and perhaps conservative method with revolving drum and double-handed casting rod. Lastly, the lover of the fly rod, who would rather cast a one-inch spoon with double-handed fly rod all day, and take his chances with the big fellows, than use casting rods and tackle.

24. *Rods*.—The short single-handed casting rod, of 5 feet or so, and in case of heavier fish, up to 7 feet in length, are generally popular.

25. *Steel Rods versus Split Cane, Greenheart and Ringal*.—The makers of the well-known Apollo steel shaft for golf clubs, have

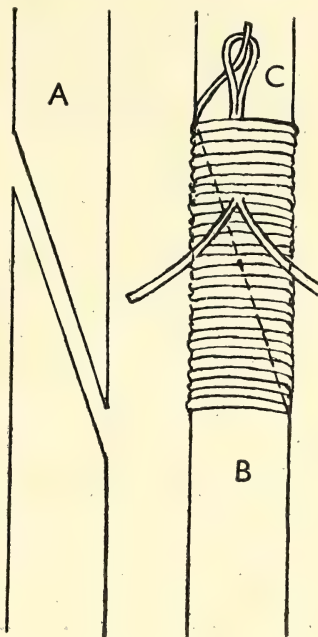


Fig. 10 A, B, C.

put on the market a variety of steel tube rods, in varying sizes and weights comparable with split cane or greenheart. In considering the merits of the steel rod, and in comparison with the split cane, I have no hesitation in saying that I prefer the latter, as it is more sympathetic with our cause, and reacts with more smoothness than the steel rod; besides it is lighter. We must, however, consider the many other aspects. For instance, the effect of the climate on a split cane or steel centre rod does not arise with the steel rod, nor does it cost as much, or call for the same care and attention when in and out of use. Then there is the ringal rod of 5 to 7 feet, built for this light work, in this country. I have seen an excellent rod turned out by Verona for this type of fishing—light, strong and a finished job, and at a moderate price. So I would advise, for the extravagant, a Hardy's 'Victor'; for the 'Inquisitive' a steel rod by Apollo or any other maker, for everyone else a ringal cane made up out here, by your tackle dealer.

26. *Thread Line Rods*.—These are made, and carefully calculated out to give a required tension with a fine line, with breaking strain of 2 to 8 pounds, by what is known as 'Test Curve' or 'Strain'. This is roughly speaking, putting a full strain on with the rod, until the line and tip of the rod are in a continuous curve, and the angle disappears. Something of this sort is necessary when it is considered what toy tackle this is, and what the effect of getting the rod, reel and line out of balance, would result in. A stiff rod would put more strain on the reel, and in turn, a stiff reel on the line, (and if the rod is a light one) on the rod too. So that rods for this type of fishing must be carefully selected, and suited to both reel and line. Makers generally grade the rod to the strength of line to be used, so this should receive your careful attention. The length generally favoured is from 5 to 7 feet.

27. *Double Handed Casting Rods*.—There is a wide selection from which to make a choice, as this form of fishing is more generally in practice than the two foregoing, and is nothing more than a modified form of part (1), but as the general run of fish will be smaller, we must have a rod light enough to fit these conditions. Probably the most popular rod is one of about 9 or 10 feet in length, and about 10 or 12 ounces in weight. If an expensive rod is required the 'Wee Murdock' by Hardy in split cane or greenheart, or any other similar rod is all that is desired. The steel rod for those who prefer it, or the ringal cane built out here.

28. *Solid Cane or Ringal Rods*.—Verona built me a nine-foot ringal rod to my specifications, and is all that is desired. I have killed several fish over 30 pounds with it, and over 2,000 pounds of fish all told, it is still as good as new. It cost me Rs. 15. I had to fix my own handle and rings. For another Rs. 15 or Rs. 20 Verona would fix a cork grip and porcelain rings, and personally I would use nothing else. No fear of binding cutting or cement opening, and the chances of repair to a solid ringal if a ferrule gets slack, or a break on a fishing trip, is so much easier than is the case with a split cane rod. I am convinced that as the building of these rods improves in this country, so will we see the exit of the expensive eight- and nine-guinea rod built in England and elsewhere.

29. *Double Handed Fly Rods*.—There are quite a few anglers in

India who prefer the Salmon fly rod to anything else, and get as good sport, but wielding a 12-foot double handed fly rod in an April sun, is hard work. It is grand sport getting into a big fish, and if you wish to make comparisons of the fighting qualities of Salmon and Mahseer, then take on a Mahseer with this tackle, and compare timings, etc., with your catches of Salmon. Individually, you will be satisfied I think. I have kept detailed notes of my fishing trips, and here are three extracts from my diary.

24th April 1935. (1) Fishing in the Sarju in Kumaon, above Bageshwar, at top of Balaghat Gorge, with a 10-foot fly rod, a medium trout gut trace, and one-inch spoon. Hooked at 6 p.m. landed at 8-30 p.m., 600 yards below where first hooked and in third pool down. 29½ pounds. (No sulking).

20th March 1938. (2) Fishing in Nepal in a river about the same size as the Sarju, 25 pounder hooked in 'Bootha' rapid at 9-10 a.m. (my wife kept the time) at top of run, followed him down bank 600 yards, with 100 yards of line out, to tail of pool, then up again half way up rapid and back down into pool. Killed at 11-20 a.m. on the same tackle as mentioned above. A black Mahseer.

12th October 1940. (3) Ladhya River, Kumaon. 9½-pound Mahseer, hooked on 10-foot Perfection Rod, medium trout gut cast and half-inch spoon. Killed in 49 minutes. (Time taken by my two companions.)

These are not isolated cases from the point of view of fight, though they are lucky for the size of fish, as the usual run of fish was very much smaller. The charm of this type of fishing is that you avoid all the 'ironmongery' as used on spoons, plugs and dead bait, of two and three trebles, but just have the one single hook on the fly spoon, and so get as near home conditions as possible. The type of rod needs no mention here, a fly rod used for heavy Trout and Salmon, fits these conditions also.

30. Rod Fittings.—Use only the best rings. The expensive rod is usually fitted with good rings, but watch the cheaper ones, and insist on Agate or protected Porcelain rings at the butt and end. Ferrules, either 'lock fast' or 'Suction', if of a good make and well put on, are the best. Winch fittings should be 'anti-friction', avoid the types that fix the reel with a hand nut or screw, and try to get the screw grip as used by Hardy's or the sliding ring type, but see your reel is rigid, or accidents will occur. The grip should be of cork, which is universal to all well-made rods. Agate rings are easily damaged, and the fine crack may escape notice. A perfect rod-ring would be one of rustless steel.

31. Reels.—American reels, though grotesque looking, with large winding levers, and wardrobe handles, besides innumerable nuts and screws are none the less popular and cheap. They are the wide drum types, with a line guide which is very useful, and holds a distinct advantage over the popular English makes. This is called 'Level Wind', and the brake to stop over running 'anti back lash'. Most of the reels listed by the Indian dealers (Verona and Manton) are made by Pfluegar, the name familiar to the plug bait enthusiast. I have not used these reels so can offer no comment. The line guide for 'Level Wind' appeals to me very much, as it must save the inevitable 'Crow's nest' caused on the Silex and other direct

wind casting reels. I do not know how the check works, or if it can be adjusted to put sufficient strain on, to hook a fish direct.

32. *English Nottingham Type Reels*.—Of these, the Silex is best known, and even though it is expensive, once got into is a treat to use. There are 'Major Silex', 'Super Silex' and 'Sea Silex', and 'Multiple wind Silex', so the choice is wide, for those prepared to pay a big price for a reel. Then there is the 'Easy Cast' reel which is another type, or the 'Asco' built by Albert Smith. These are all on the revolving drum, Nottingham principle, and share the same features in general. The size should be governed by the amount of line needed, and the correct size to balance the rod.

I have stressed elsewhere, that 150 yards of line for light fishing and 300 yards for the heavy work, is what I recommend, if fish run large.

33. *Stationary Drum Reels*.—Better known as 'Thread Line' or 'Wanless Tackle'. This type of reel is a highly mechanical device, enabling the angler to fish with the lightest of tackle. The drum is stationary except when playing a fish. It is on the 'Malloch' principle, the drum being at right angles to the rod, enabling the line to run off by uncoiling itself off the drum, while casting. A 'flier arm' or 'guide' picks up the line at the end of a cast for a multiple wind in. There is an adjustment to the reel to increase or decrease tension, depending on the other units of the outfit, that is, the line and rod. A correct ratio of balance and tension must be carefully made, for this gear to work effectively. There are many makes, but I regret I am not in a position to make a recommendation, as I have no experience in this line of fishing. In concluding my remarks I am firmly convinced that tackle makers do not fully realise the strain heavy Mahseer fishing puts on the reel, and I can only suggest that if you are buying your stuff at Home, and you cannot convince your tackle maker of the strain on a reel, in the first rush of a Mahseer, hitch your line on to the back of your car, and run it out as fast as you can for two hundred yards then hand him back his reel to look over, and tighten up the loose nuts and screws! but if it has stood this test, and is intact, buy it.

34. *Casting Line*.—For medium-sized fish a fine line with a 14- to 18-pound breaking strain, and fine backing, is all that is necessary, and as to types and makes, the same remarks hold good, as in part (1) of this chapter.

35. *Thread Line*.—'Gut substitute' or 'Ja-Gut' is used, but it is brittle and apt to stiffen up on the drum, and run off in kinks, rather like a cork screw, so that the silk lines, specially made for this tackle are preferable.

36. *Traces*.—As already mentioned, Killin wire is the best for traces, fine or medium, made up with three small swivels, on two 18-inch lengths of wire, for spinning, with longer single lengths and two swivels, for plugs.

For thread line work no trace is required, if the gut substitute is used; with a silk line, a fine gut trace of three feet or so in length is all that is necessary.

For the double-handed fly rod, a gut trace of 6 feet in length

with three swivels, is ideal, grading the gut to the size of fish expected. If the river is very rocky and full of snags, the new 'Alasticum' wire is excellent. It is made in finer grades than Killin wire, and down to 5 pounds breaking strain, which is almost invisible in water, and as fine as hair.

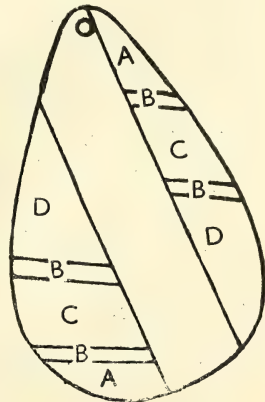
37. *Lures*.—*Plugs* $4\frac{1}{2}$ inches long either jointed or in one piece, make an excellent bait for the short single-handed casting rod, or for rapids where the water is rough and shallow with plenty of 'White Feathers'. They have one great advantage over spoon in this type of water being made of wood they float, and do not grip the water till the line is taut, whereas the spoon sinks until felt by the line, and is consequently frequently hung up in snags.

Spoons.—I fancy the long narrow type $2\frac{1}{2}$ inches long, the back scaled in brass or copper, and dull silver inside, for the usual clear waters of most northern rivers in March and April, but I carry an assortment of 18 or 20 varieties. Follow the general principle of using spoon, and you will not go far wrong, as mentioned in part (1) If you buy ready-made traces and mounted spoons, you will find yourself connecting up in a chain of swivels leading your spoon. The spoon is sold with a large swivel attached to the eye by a brazed ring, the ready-made trace is supplied with either one or two link swivels, to attach to the spoon, so, when your spoon is mounted to the trace you have this chain of metal leading the spoon very often longer than the total length of the spoon. Come! Come!! Tackle makers and anglers alike, this can surely be improved upon and the insult to the fish removed!

Fish a spoon as I suggest with the 'Myitkyina' spoon. Thread the spoon and mount on to the link swivel, and you have a strong and tidy job. A spot of red on a spoon, has been given to me as a tip, by an experienced angler, but I have not really given it a trial, and here I reproduce, from the *Field* of 15-8-27, a camou-

Fig. 11.

- A. Vermilion.
- B. Yellow Ochre.
- C. Burnt-Cinnamon.
- D. Grass Green.



flaged spoon, by the same angler, which may be of interest to some. 'Sealing wax of various hues, dissolved in small bottles (2 oz. ones) with methylated spirits. Paint on with soft brush. Paint takes some hours to dry, and longer to become hard; use best English sealing wax. See diagram of camouflaged spoon (fig. 11)

Dead Bait.—Mount dead bait in the manner outlined in part (1), or on the lighter Archer Spinner, to suit the conditions of water and tackle.

III. FLY SPOON AND THE SINGLE-HANDED FLY ROD.

To the majority of anglers, this is the essence of sport. It is a relaxation, whereas the big rod is a labour. The 'Gentle Sex', or elderly, can enjoy it with little discomfort or hardship. In fact one can safely say that every angler will fish with a single-handed fly rod, while only a few will set it aside for the big rod, and fewer still will spend a day wielding the heavy rod, if fly spoon work is handy. Besides which, abundant water is available throughout India, to indulge in this form of fishing.

38. *The Rod.*—The best rod you can buy is no extravagance for this light fishing, as the qualities required cannot be had in a cheap one.

If you are stationed near a small river, like the Tochi or Kurram in the N.-W. F. Province, and only small fish are available, then the lightest of rods and tackle will be necessary if you wish to have good sport. A 9-foot rod, suitable for trout, suits this water admirably, because only a small quarter-inch spoon is used, or a large fly; but if the more general conditions of Northern India are your lot, and you are within easy distance of the larger rivers, then a rod will require careful selection. In the chapter for the novice I have stressed the points to look for in a rod for this type of fishing, and here I can only repeat that the fly spoon work in a large river, where the general run of fish is 5 to 10 pounds, the 15, 20 and even 30 pounder will quite often take a small spoon, and we find ourselves ill-equipped to deal with these monsters, chiefly because this type of fishing has never been fully understood by the rod maker, and he thinks that a rod which is good enough for a large trout, will more than fit the requirements of the Mahseer. Let us consider the chief differences.

(1) The water is much bigger and stronger than the average English trout stream. See photograph opposite.

(2) The spoon fished in this water has a much greater resistance to offer a rod, than any fly, and both while spinning and at the time of recovery puts a far greater strain on a rod, than a non-spinning lure.

(3) The sun temperature in March or April, or in October, is sometimes as high as 110 degrees in the day (Mad dogs and Englishmen . . .) dropping at night to 75 or 60 degrees. This affects steel centre rods more than the others, but a rod in use for 10 hours a day in this sun temperature is hardly getting the same deal as one in use on an English summer's day.

(4) How many trout over 5 pounds are caught by a single rod, in a season? whereas the average run of mahseer in this type of fishing, is over this figure. See photograph opposite.



Bag of eleven fish weighing eighty-seven pounds, taken on half-inch fly spoon, out of rapid below.



Typical fly spoon water. Note 'White Feathers'.

It would therefore be well to try to convince your tackle dealer of these conditions. After all, if we pay 10 guineas or so for a high-class rod, built for English fishing, it becomes an expensive and poor investment if it is to be replaced every other year or so.

The ideal rod I recommend is a double built split cane, in two pieces for preference, 9 to 10 feet long, as light as it can be made, to recover a half-inch spoon, without straining the point, from a water shute! It should take a reel to hold 150 yards of line, with Agate rings at the end and butt, and with a spare top. But, most important of all it must be as pliable as possible, to assure accuracy in casting, as you will frequently be fishing water, where innumerable boulders will be jutting out, and the spoon must be kept under perfect control, or you will damage it against a rock or get hung up, besides which a pliable rod is imperative to hook and hold a fish with light tackle.

I do not think these simple requirements are beyond the scope of the modern rod builder, nor do I see why they should not be turned out, inside the price charged for superior dry fly rods. If one of the tackle dealers out here would be enterprising enough to get a rod built on these principles, I am convinced sales would be assured.

39. *Reels*.—Any good quality fly reel, free from levers, etc. to foul the line, with a capacity to take 150 yards of fine line, and with an adjustable check strong enough to hook a fish off its own, is good enough. For the lighter fishing any ordinary trout reel will suffice.

40. *Lines*.—Tapered fly lines may be used with the light tackle, if a quarter-inch spoon is the lure, but the ordinary braided line mentioned in part (2) of this chapter, fits all the requirements for either large or small fish.

41. *Traces*.—For small fish 2X gut is good enough. The best gut is the cheapest in the long run. I have used drawn-gut casts and traces for three or four seasons, and only discarded them because they had frayed, as a result of being rubbed against rocks while playing a fish. Keep gut in flannel when not in use, and in a dark air-tight box, and it will keep indefinitely. For the heavier type of fishing use fine, medium, or stout Trout size gut traces. If you have your traces made up for you, insist on 5 to 6 feet for length, and the finest swivels you can get.

42. *Treatment of gut and how to tie traces*.—I give the method I use both for soaking gut and tying traces with every confidence. I have traces still in use that I made 4 years ago, with gut that is 8 years old. If you take the trouble to follow these instructions you will have the same good results.

It is most important to soak gut that has been lying by for long periods gradually. Damp a flannel rag 10×10 in. in lukewarm water, fold it into two and lay the gut strands in it, then fold into four and leave overnight, cover it over with a finger bowl, this helps to retain the moisture in dry weather. After the gut has soaked overnight it can be removed from the damp flannel and put into a bowl of lukewarm water. It should by this time be soft and ready to tie,

43. *How to tie a cast.*—(1) Test and grade the strands of gut (drawn gut is graded), take two strands at a time out of the water and tie together; put these back into the water, and tie the next two strands and so on until the jointed lengths are also tied together, or attached to swivels, cut the ends close and you have the job finished. Dry the trace gradually in a moist flannel, and you will have eliminated all risks of the trace letting you down.

44. *Knots for traces.*—There are several knots used for tying gut, I will give three of the better known, and in order of my personal choice.

(1) *The Lovers Knot.*—Place the two strands together as in fig. 12 *a* with the ends lying in opposite directions, make a single overhand knot at each end, then give each end a double turn through its own ring and over the gut strand, draw first one end moderately close, then the other. Each should fall into two neat coils around the other, bring these coils close together, then pull tight and up against each other pull the ends and cut away.

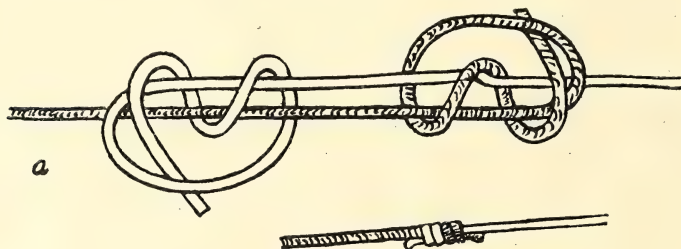


Fig. 12 *a*.

(2) *Buffer Knot.*—This is a simple but serviceable knot, easy to follow and tie. Make two simple overhand knots, one in each strand, and pull close leaving enough room to thread a strand of gut through thread each through the other pull tight and draw the knots together; give the short ends a further pull, and cut away (fig. 12 *b*).

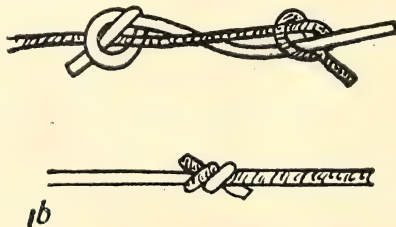


Fig. 12 *b*.

(3) *The Barrel or Blood Knot.*—For those who wish to be expert and who like knots for the fun of tying them, this is the tidy and finished job, though sometimes tedious. Hold the two strands together and turn one right handed and the other left handed; with the same hold thread the ends back through the centre and with the

coils and ends held with the lips pull tight the strand and ends. (fig. 12 c).

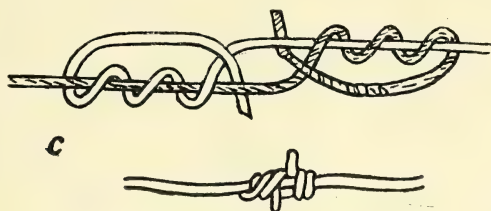


Fig. 12 c.

45. *Knots for attaching gut to swivels.*—I always use a simple loop, threaded through the eye of the swivel, then pass over the other end and pull tight. This gives extra strength at joins and eliminates the swivel cutting through the gut, but there are other knots that can be used. I give three of the most popular though I personally recommend the simple loop as the most reliable. (See fig. 13 a, b, c).

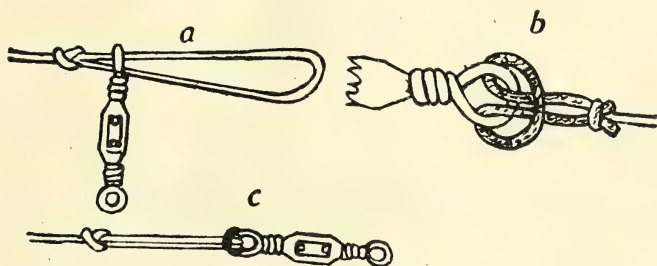


Fig. 13 a, b, c.

(1) Double the end of gut and make a simple knot, pull the loop and small end tight and cut away (fig. 14 a).

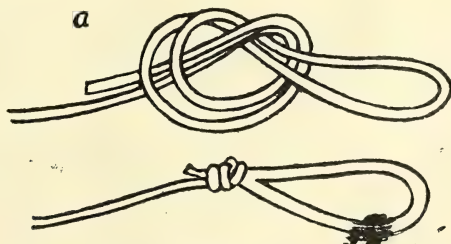


Fig. 14 a.

(2) Another way of making a loop is to tie a single overhand loop in the gut, turn the shorter end back and thread through the knot.

Then make an overhand loop over the strand with the short end, draw together and pull tight. Cut away ends (fig. 14 b).

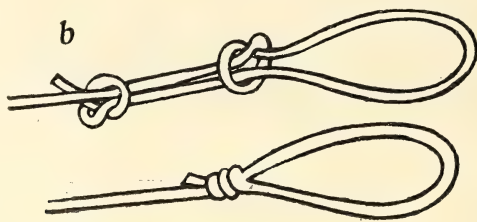


Fig. 14 b.

(3) Pass the end of the gut through the eye of the swivel, then bring it back and make an overhead knot, give the end a loop under the main strand, pull tight and cut close (fig. 14 c).

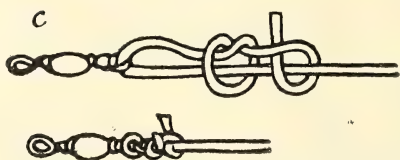


Fig. 14 c.

'Alasticum' is finer and stronger, for those who prefer wire. Gut substitute is also fancied, so that the choice is wide. I personally recommend natural gut, made up oneself, with a large gut loop at the end to mount the spoon or bait, and with two very small swivels. One swivel should be at the end of the trace to which the line is tied, and one in the middle, i.e. from either end. The fly spoon provides the third swivel fixed to the loop of the trace (fig. 15).

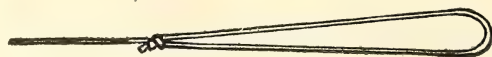


Fig. 15.

In making up wire traces follow the same procedure, only instead of the loop, attach a small Hardy swivel to the end, to thread on to the fly spoon by split ring (fig. 16).

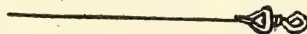


Fig. 16.

46. *Lures*.—We have a big assortment of lures from which to select. Spoons of varied kinds, insects, flies, feather lures of the Evelyn types, Celluloid Minnows, Heddon Spooks on the plug principle, besides the small bait mounts for dead bait, all of which can be used on the fly rod. I will take these in order or in groups, so as

not to make this note as confusing as a tackle catalogue; for every bait therein is advertised as excellent. Let us take for instance the text below two such baits from Manton's catalogue.

Bar Spoon.—'Fished as a fly we know of no more deadly lure for small Mahseer'.

Mother-o'-Pearl Spoon.—'Many a sulky fish can be raised to this spoon that would not raise to anything else'.

The Fly Spoon.—Fly spoons vary in size from one inch to a quarter of that size, and are built heavy, medium and light and coloured in the usual copper, brass and silver, or a combination of these colours. The Mother-o'-Pearl spoon is very popular for cloudy water. The spoons themselves are made with either a flying or stationary mount, as in the Bar spoon.

Let me draw your attention, first of all, to Manton's catalogue, where a large assortment of spoons are excellently illustrated, and I also call your attention to the method generally used for mounting spoons. You will see that only in one instance is the swivel lead small and tidy, this is on Hardy's fly spoon. On the other makes of spoons large ugly swivels are mounted. Surely with the gin-clear water, which is so general with the Indian rivers, we should be particularly careful to avoid this. I give a simple but effective way of mounting spoon on to either gut or wire, in part (2) of this chapter, which will be a great improvement; and which has the better chance of attracting fish? (fig. 17 *a* and *b*)

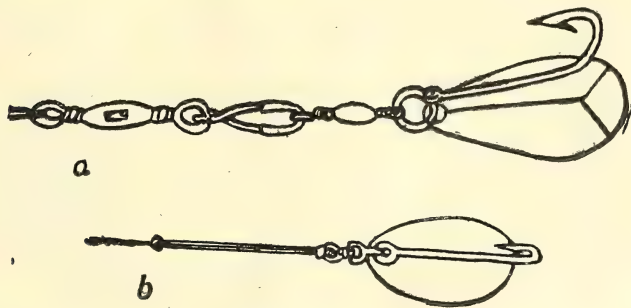


Fig. 17 *a*, *b*.

If you applied the first method to trout at Home, you would be considered as raving mad, yet quite a few people will put this to a Mahseer, in water gin clear; quite apart from the appearance of this swivel chain, think of the vibrations it must set up in opposition to the true spin of the spoon. All that are required are some Hardy's swivels, some good split rings, hooks and spoons.

Split Rings.—Although I deprecate the use of split rings, with heavy tackle, they are excellent for this type of fishing, where they are not subjected to heavy strain, and will stand up to the biggest fish taken on this light tackle, if kept free from rust and well oiled.

In offering advice in the choice of fly spoons, it largely depends on the rod. First find the best weight of spoon to suit your rod, then have an assortment made up in the different shapes and colours to suit your fancy. A flat spoon will tax the rod less while spinning

than a hog backed one, so you can increase or decrease the size to suit the shape. I myself fancy the long narrow type for reasons already mentioned, and the semi hog backed type like Hardy's, with a flying mount, as I think it has a better chance of hooking and gives better deception than a bar spoon, when the mount is stationary. I use copper and silver, one as much as the other, depending on the water.

In rivers with dark coloured boulders, I like a spoon with the copper almost black inside, and silver out. In fairly deep water I like silver; and in fast shallow runs, and lightly coloured rocks gold and silver; but there is little choice in any of them. I am not in favour of trebles for fly spoon as for one thing, if they are strong enough, they are too heavy, and if light not strong enough. I am a great believer in a single flying mount as illustrated on the narrow spoon I recommend. I do not think small trebles are as effective or hook as well as a single hook.

The Bar Spoon revolves around the bar through the spoon, and is preferred by some to the ordinary type, but I cannot say I have had much success with it. The 'Lindsay' spoon sold by Verona is on this principle. Mother-o'-Pearl is very light and pretty in the water, and very good in some rivers. I have had success with it in coloured water.

I produce here four types of fly spoons I fancy. See fig. 18 *a, b, c, d*.

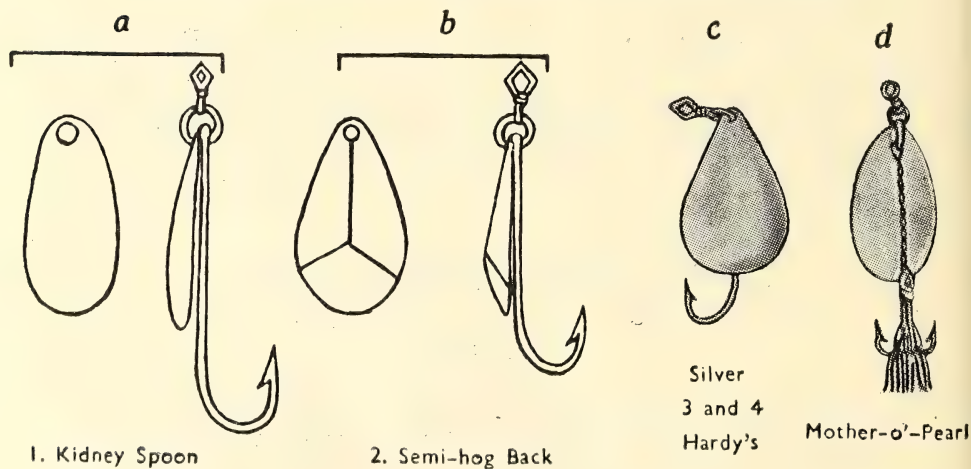


Fig. 18 *a, b, c, d*.

No. 1 I like best, and have found most successful in all types of water.

No. 2 is semi-hog backed.

Nos. 3 and 4 are both made by Hardy, and are excellently mounted.

Remember when selecting spoons to study the mounts. Single hooks not trebles on fly spoons. Small swivels and small rings.

Hardy's Mother-o'-Pearl spoon is mounted with a treble, but

a strong single hook, on so brittle a substance as Mother-o'-Pearl is apt to chip or crack it while casting.

Colours.—The best colours are a combination of gold and silver, or copper and silver, or all silver, just whichever suits local conditions best. A tag of red cotton on the end of a hook is sometimes effective.

Insect Lures (Artificial), made up as spiders, beetles, etc., I regret to say I have no experience with; but they are attached to a gut cast and used as a fly. They might be good in lakes or in pools. I do not think they are as effective in rapids as spoon.

Fly or Feathered Lures.—These will take quite well in slow runs, and give excellent sport where water is slow and running among large boulders. I have not found either as effective as fly spoon in runs.

Celluloid Minnows or Spooks on the 'plug bait' principles are well worth trying if other baits fail, but I do not think any of these baits have the range or attracting powers of the spoon, for the simple reason that they have not the resistance.

Allcock's Minnow Mounts.—These are excellent if a small enough fish can be had, and one that will not break up with switching in and out of the water. It is deadly in all water.

I will conclude this chapter with a few general accessories that should be part of the kit carried while fishing. But do not put all your eggs in one basket, keep some in camp, some in your bag with the attendant, and the few spoons, lures, etc. necessary for changes, on your person.

Spare reel and line.

A small tin box with penknife, a pair of scissors, baiting needle, silk and wide-eyed sewing needle, and spare attachment links and swivels, pair of wire cutting pliers, and a spool of Killin wire, for mounting dead bait. A small watchmaker's hand vice should also be included.

Weights.—Carry some spare in assorted sizes to replace losses.

Spoons and Mounts.—Carry these in one or two suitable sized tins, to fix to traces as suggested in part (1) of this chapter.

Spinners.—Have two or three spare Crocodile or other fish mounts handy in different sizes.

Traces.—Carry a book or tin with a couple of spare wire traces, and gut traces, in case of breaks.

Weighing Machine.—A good scale graduated to 60 pounds will fit all requirements.

A note book, pencil and camera are also valuable for recording good water and fish.

A roll of sticking plaster and an iodine pencil are handy to have as tosses and cuts frequently occur while wading.

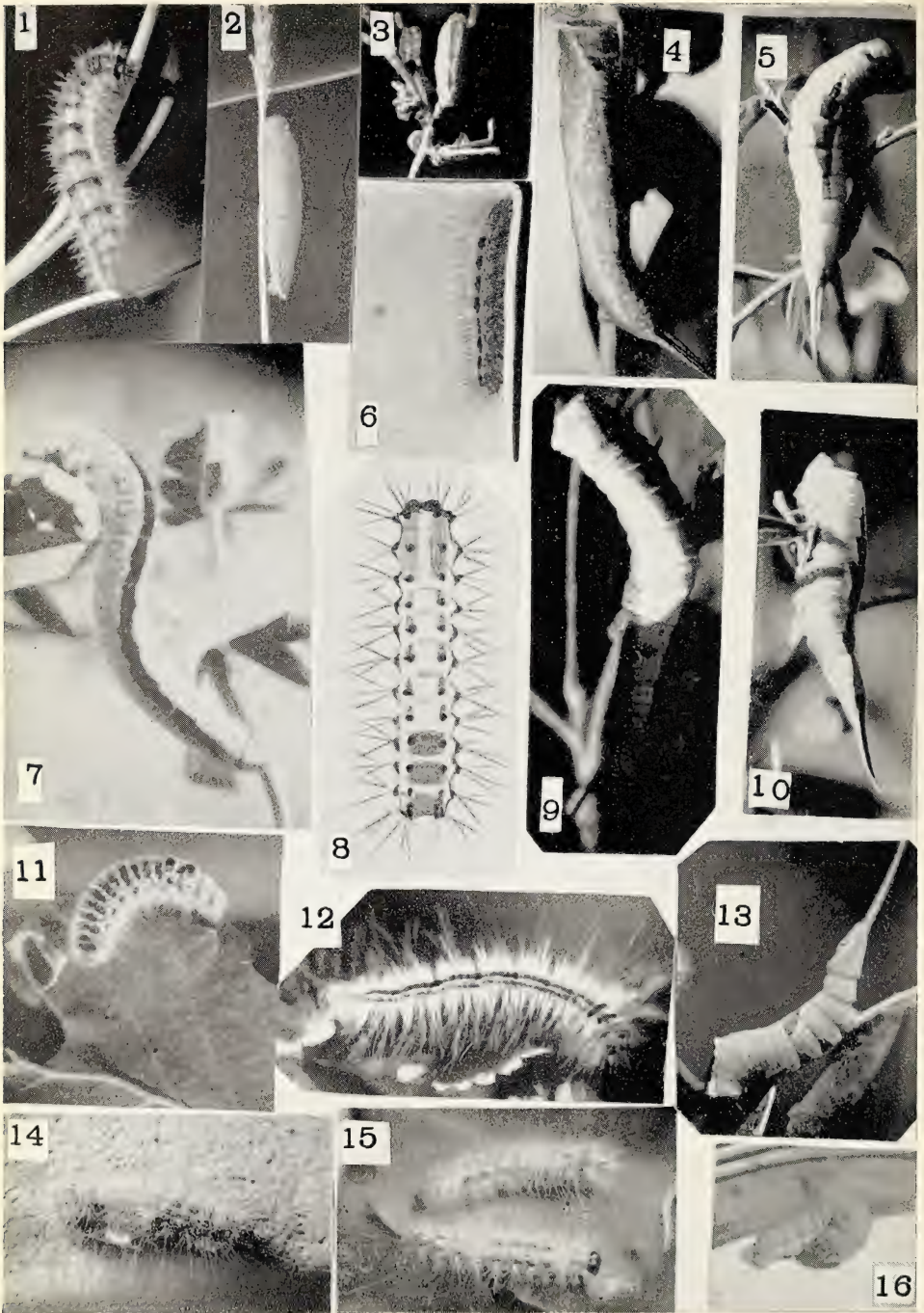
Carry on your person, a turn screw to fit all screws on your reel and a small tin box to fit conveniently into a pocket with some spare fly spoons and other lures, so that you can change from one to another while fishing, if necessary.

47.—*List of tackle dealers.*—I give, in conclusion, a list of a few of the tackle makers and dealers known to me. There are many others of course, but if you get an Angler's guide or price list from

one or more of those mentioned, you will be able to understand and follow easily the text of this chapter.

- (1) The Army & Navy Stores, Bombay.
- (2) A. E. Verona, 153, Dharamtolla Street, Calcutta.
- (2) Manton & Co., Old Court House Street, Calcutta, and New Delhi.
- (3) Mrs. Allen, Kilmore, Dehra Dun, U.P.
- (4) Oakes & Co., Madras.
- (4) Wilson & Co., Chemists, Rawalpindi and Murree.
- (5) Barton & Co., Ootacamund.
- (6) Watson & Co., Rangoon.

(To be continued)



EARLY STAGES OF ORIENTAL PALAEARCTIC LEPIDOPTERA — V.

(For explanation see end of article).

EARLY STAGES OF ORIENTAL PALEARCTIC

LEPIDOPTERA—V.

BY

E. P. WILTSHIRE, F.R.E.S.

(With 2 plates).

This paper is the fifth¹ of a series whose purpose is to bring to the notice of the public the biology of species whose early stages were previously unknown, or new facts concerning the early stages of species better known. Most of the species here described were studied in S.-W. Iran. Two new races and a new form are also here described.

Aporia crataegi L. (Plate I, Figure 1).

The larval form in Fars seems to differ from that in Europe, as described by Blaschke, Wagner, etc.

The mature larva is pale grey below, blue-grey on the back. On each somite are two patches of short red hairs, bordered on either side and separated from one another by black patches. Other hairs, longer, white. Head, black. Spiracles, black, set in a pale area. Underside, darker grey. Somites 1 and 2 have yellowish lateral hairs. In the figure the dorsal line appears paler, but this is not always so.

The European larva is said to have a red sublateral line, quite lacking in this form. In the larva of *castrensis-kirghisica* (vide sub.) the Fars larval form differs from the European by a somewhat similar simplification of markings. Perhaps this is a reaction to intenser light; I have previously remarked that the larva of *Celerio euphorbiae* L. reacts individually to a less intense light by becoming blacker. But that reaction was perhaps more a parallel to the darker pigmentation of certain imagines in captivity or in cooler damper climates than in free-bred imagines in desert climates (e.g. *Chloridea peltigera*) than a parallel to the above lack of coloured markings. Geographical variation in the markings of larvae is already a well-known phenomenon.

The above larva feeds on *Prunus* and *Amygdalus*, attaining full growth in April or May.

Melanargia larissa Hubn. (Plate I, Figure 2).

The larva is either pale brown or grass-green, and tapers to two short tails. Dorsal line, darker (brown or green); subdorsal and sublateral lines, paler (yellowish), the latter interrupted, the former shaded below with darker on the hinder somites. Spiracles, pale, inconspicuous, lying between the former and the latter. The tails are paler edged laterally.

Pupa: pale brown, with brown-freckled wing-cases. Cremaster, a short blunt brown cone tipped with about ten short bristles. On shoulders, near the eyes, and just behind the antennae, is a pair of black excrecent spots. Dorsal line, vague, grey. Period, 19 days, in May.

The larva feeds at night on grass. The imago flies throughout May in Fars, but not below 5000 feet. Further north along the Zagros range, it is found much lower down.

¹ Previous articles in the series appeared in:—

Ent. Rec., Vol. xlvii (July-Aug. 1935); *Ent. Rec.*, Vol. xlviii (Oct. 1936); *Mitt. Muench. Ent. Ges.*, e.v. xxix, Jahrgang, 1939, Hft. 1; and *Ent. Rec.*, Vol. lii. (June-July 1940.)

Identification :—I follow Brandt in calling the Fars *Melanargia 'larissa'*, but must mention here that specimens of it sent to Mr. H. J. Turner were identified by him as *M. hylata* f. *irantica*. In any case, I am not yet satisfied that *hylata* is a distinct species from *larissa*.

***Thecla abdominalis* Gerh. gerhardti** Riley. (Plate I, Figure 3).

Brandt records this species as *marcidus* Riley, but after studying Riley's original descriptions I favour the above determination. The species varies greatly.

Larva—when young, yellowish green, with deep crimson dorsal markings. When mature: green, with a reddish purple lower edging on somites 9 and 10 to the yellow lateral line. The yellow subdorsal lines are interrupted at the somital joints. Oblique lateral stripes, very faint, darker green, yellow-edged above. Head, glossy black.

Pupa :—purple brown, hidden low down near ground.

Foodplant :—*Prunus* and *Amygdalus*; also *Crataegus*, *Eleagnus*, and occasionally *Lonicera persica*.

The imago flies in May after a short pupal rest, at 5000 feet and upwards.

***Lymantria amabilis* Chr.** (Plate I, Figure 8).

Larva, dull grey-brown, with dark brown warts, from which spring light brown hairs. Dorsal line, vaguely indicated by a slight whitening of the centre of each somite on somites 1-8. Somites 9-11 are entirely deep purple brown dorsally, except in the joints. On somites 4-8 the subdorsal warts are heavily stained with deep purple brown. On somites 4-10, just above the dark brown spiracles, is a series of elongated oblique lateral warts, pointing upwards and forwards, of the same purple brown colour. Head, red-brown, each lobe being marked with darker brown. A series of small brown warts above the spiracles. Feet, pale, grey-brown.

The larva grows slowly, and feeds by night on *Prunus* and *Amygdalus*, hiding by day. A young larva found in April was full-grown in June and produced an imago on July 18th, after a pupal period of sixteen days. There is a second brood, but I cannot say if this is regular or only partial.

The pupa has a very broad and obtuse thorax, and is coloured deep brown, paler on the abdominal somital joints, and scantily clothed with pale hairs. Cocoon, rudimentary.

The imago comes to light in many places in Iran, especially in rough mountain country.

The second brood imagines taken in the Pir-i-Zan woods, Fars, were distinguished by traces of an inner dark band on the yellow hindwing, absent in first brood specimens. For this form I suggest the name *autumnalis*. The types are in my collection and were taken on Sept. 1, 1940.

***Ocneria insolita* Brandt.**

Described from a single dwarf second-brood male taken by Fred Brandt, I have taken both sexes of the larger first brood of this species, to light on the Muk Pass south of Shiraz on 15-6-41, at 6500 ft. in 'bann' (*Pistaccia*) jungle.

A female laid ova in a neat regular batch in diamond-formation; the eggs were bun-shaped, glossy, pale cinnamon grey, and hatched after a week.

The young larvae, grey with black heads, fed on cultivated pistaccia, but I failed to rear them past the first instar.

***Ocneria audeoudi* Brandt.** (Plate I, Figures 6, 14, 15).

Ova, laid in diamond-formation, in batches, with one or two in an upper layer. The eggs were almost spherical, dull pearly grey, glossy. They hatched after eight days.

Larva, when full-grown, greenish grey, paler on somite 3, with long brownish hairs springing from brownish warts. Dorsal line, vague, pale, with a darker edging, and with two yellowish spots on somites 8 and 9. Under a lens these spots prove to be wart-like processes not to be found on other somites. Subdorsal lines, vague, pale, with a heavy black upper edging; in the penultimate instar, instead of such an edging, the subdorsal warts are merely blackish on somites 1, 2, 4-7, and 9-11 inclusive. The black edging in the last instar however is only on the abdominal somites. Above each lateral wart, and placed on the subdorsal line, is a pink spot on each somite.

Spiracles, black, almost hidden by the hairs from the lateral warts. Head in last instar, glossy blackish brown with a yellowish inverted V-mark. The greenish ground colour is apparently due to internal colouring, for it disappears when the larva is blown.

Foodplant :—*Pistaccia*. The larvae fed up readily on the cultivated kind.

Larval habit :—by day hides gregariously low down, in crevices; if disturbed, runs, but retains a tenacious foothold. By night, after a very rapid climb to the foliage where it feeds, it often rests quite motionless for long periods, but if disturbed jumps and drops immediately. When full-grown (mid-August), the larva makes a transparent cocoön and there pupates. The pupa is yellow-brown, glossy, and darker brown at the somital joints and on the thorax and wing-cases; the hairs, chiefly on the back of the abdominal somites, are yellow-brown. The second generation emerges in the second half of September.

The imago of the first brood comes to light in June in 'bann' jungle, in Fars.

***Porthesia melania* Stgr. (Plate I, Figure 11).**

Larva, black, with dense white bristles and tufts of hair. Head and claspers, brown. Somites 4 and 5 each bear a short thick tuft of black hair. The abdominal somites are particularly black dorsally. Foodplant :—*Quercus* and *Prunus*.

Cocoön, closely woven, thin, flabby; among leaves and litter.

The larva is full-grown in the second half of May in the high woodland of Fars, and produces imagines in June, during which month the males come to light. So far I have only obtained females by breeding. This species occurs in the Zagros woods from Fars all the way to Anatolia.

***Eriogaster amygdali* Wlts. (Plate I, Figure 12).**

I described the early stages of this species in my original description (*Journ. Bomb. Nat. Hist. Soc.*, August 1941) so I refrain from repeating it here, but simply give an illustration of the mature larva.

I might add that I have seen egg-clusters, presumably of this species, as low as 800 feet, in February on the Filfil Pass near Dalaki, Fars. The eggs however were empty, and must have been laid two winters earlier, for there were no traces of larvae on the bush of spiny almond. At this height no doubt the quick-growing larva must grow up very early in the season, and the pupal period be proportionately longer. Evidently the species is widely distributed along the Zagros range, and is probably the same as the species I recorded without naming from Iraqi Kurdistan, though I have not yet been able to compare the specimens.

***Malacosma castrensis* L. kirghisica Stgr. (Plate I, Figure 7).**

I have seen old eggs of this species on thin thorn twigs. They are similar to those of the better known congeners.

The larva in Fars is a beautiful and distinctive beast, and differs from that of European *castrensis*. It is blue, powdered with big and small black dots; the spiracles are black. Dorsal line, double, black, with a bluish centre on the thoracic somites; thereafter it becomes broken up into black lines, its general colour here being purple. Along its whole length it is broadly edged on both sides with brick-red, the whole forming a conspicuous red-brown dorsal stripe. Head, grey-blue. The fine soft long hairs are whitish brown. Underside, creamy; ventral line, black broadening on each somite conspicuously. A paler lilac-grey spiracular stripe is ill-defined.

Foodplants :—*Euphorbia* and *Umbelliferae*.

At 6-7000 feet in Fars the larva is full-grown in early May; at the same season at 9000 feet (as on the Barm-i-Firuz mountain near Ardekan, Fars) the larvae are scarcely half-grown. They are gregarious, especially when young.

The imago flies at the end of May in Fars at 6-7000 feet., in July at higher elevations in Fars and the Elburz range. It comes to light commonly, and can occasionally be found by day on vegetation.

***Pachypasa otus* Drury.**

For this well-known larva I am able to announce a new foodplant :—*Pistaccia*. (One larva, at 8000 ft., Kuh Sabz Pushan, near Shiraz. This larva produced an imago on July 31st.)

Cerura turbida Brandt. (Plate I, Figures 5, 10).

Larva, blue-green, with a few faint whitish lateral freckles. Spiracles, yellowish, with blackish-brown rings; below them, some scanty brown speckles. The brown dorsal markings are edged broadly with greenish white, and consist of a triangle on somites 1 and 2, pointing backwards, nothing on somite 3, a fine spear-head on 4, a purple red-brown-edged shaft on 5, a broader, similarly coloured 'tulip' on 6; somite 7 begins with the base of a similarly coloured parallelogram which narrows until the posterior edge of somite 8; the red-brown and white edging are absent from the parallelogram along the anterior edge of somite 7 which coincides with this figure's base, and this is the only part of the dorsal markings without such an edging. On somite 9 the red-brown edged purple shaft widens slightly; on 10 it is slightly wider; but it narrows towards the posterior end of this somite. On 11 it is very narrow, on 12 and 13, broader. Tails, yellowish, faintly banded with brown. All feet, orange brown. Face, light brown. Underside, on ss. 10-13, with a purplish ventral line edged with paler.

Foodplant:—*Populus euphratica*.

The larva spun up on 20-iv-41; the imago hatched on 16-v-41. The cocoon was typical of the genus.

The above larva, which appears in the plate, was obtained at Shapur in Fars, a little higher up the same river as Brandt's type-locality. I have also bred this larva and found imagines at Bagdad; these imagines were identified for me as *turbida* by Herr Daniel of Munich. They were far less suffused with smoky grey than the Fars examples, and this pale, whiter race from Iraq seems to deserve a name; I suggest: *clarior* subsp. n. The types are in my collection and were found on trunks of *Populus euphratica* at Bagdad in June. The above dates presumably represent a second generation. The species appears to be the only representative, in hot desert oases, of the *interrupta* group.

Cerura syra Gr.-Gsh. (Plate I, Figures, 4, 9).

Larva, green, laterally speckled with orange-brown. The dorsal chain is chocolate coloured and interrupted, in the last instar, behind the hump on somite 2, but, as the figure shows, the interruption is less than that in *turbida*. The white edging to the dorsal markings sometimes suffuses the whole dorsal area, as shewn in figure 9. The dorsal line is double, fine, chocolate-coloured, and interrupted at the somital joints. Around this dorsal line and close to the edges of the dorsal chain, the chocolate colour is deepest, but in between it is paler. The broad section of this chain on somite 11 in shape and pattern resembles a tulip flower. Head, brown, with a black spot high up on each cheek.

Foodplant:—Poplar (Lebanon).

Cerura sp. (Plate I, Figure 13).

For the sake of completeness I also give a photo and description of a larva of the *Cerura* genus which feeds on poplar at Hamadan and Tehran, Iran, although I am unable to name the species with certainty. This larva is bright green, and the red-brown dorsal area is thickly edged with yellow. Somite 4 is, as is *turbida*, quite devoid of dorsal markings, but, as the photo shews, the dorsal chain has a quite peculiar outline. On somite 11 the only dorsal markings are a yellow-edged fine brown line. The dorsal line is yellow on the thoracic somites, darker on the abdominal somites. The tails carry a faint yellow band near the end. Feet, orange. On somites 10-12 there is an orange ventral line. Spiracles, pinkish, orange-rimmed. Head, brown, black under the mandibles, and just visibly black under the hood.

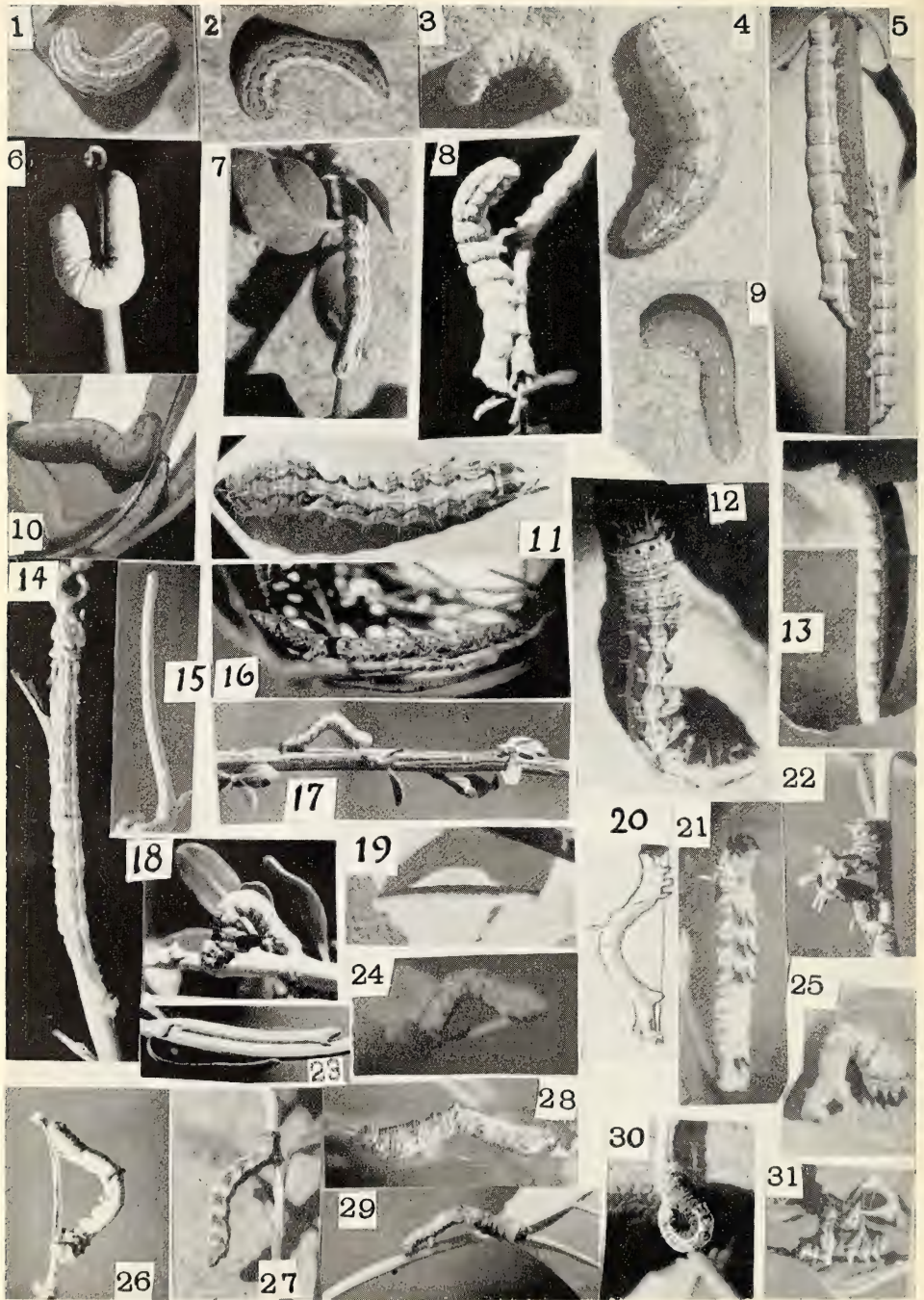
Foodplant:—Poplar and willow.

The imago comes to light in June, July and August. An August 1939 larva hatched on 14-v-40.

Besides the above species, Iran has two more *Cerura* moths:—*furcula* ssp. *pseudobicuspis* Dan. (Tehran and Elburz) and *pulcherrima* Brandt (Fars). Of neither of these have I obtained larvae, unless the Tehran species above described is *furcula*; I have not enough material to be quite sure that it is not.

Agrotis (Ogygia) facunda Drdt. (Plate II, Figures 1, 2).

Ova, bun-shaped, white; sculpture, not visible under a small-power lens, but perhaps responsible for the 'matt' appearance of the egg's surface. A



EARLY STAGES OF ORIENTAL PALAEARCTIC LEPIDOPTERA — V.

(For explanation see end of article).

black apical dot and ring appear later. Some eggs were laid loose, others in a large dense batch. Period: 11 days.

Larva, immediately after hatching:—dark grey, with black head and thoracic plate.

Larva, in later instars:—subsequent instars are similar to the last instar, except that the markings are less intense. Final instar:—brown and grey; dorsal line, double, blackish, with an interrupted paler centre. Sub-dorsal lines, finer, black, with a broad pale brown area above and a fine paler lower edging which is obscured by heavy grey mottling. A thick blackish stripe runs along the sides, above the black spiracles. Usual dots, black. Below spiracles, a vague red-brown spiracular line running in a pale grey area, below which the underside's grey mottling begins. Thoracic plate, marked with a white dorsal and subdorsal lines. Head, brown, black-marked.

It feeds on low plants at night, hiding by day in the earth. In a natural state it overwinters.

The imago came to light in late September at 7000 ft. in Fars.

Agrotis (Dichagyris) singularis Koll. (Plate I, Figure 16).

Ova, bun-shaped, glossy, ivory-white; sculpture, very faint. Period, 14 days.

Larva, when freshly hatched, pale grey, with glossy black heads and black narrow thoracic plate.

Later:—sandy grey, freckled with light brown, and with a faint diamond pattern on back. Somital joints, rather ochreous. Dorsal line, white, dark-edged, continuous on the thoracic somites, obsolescent thereafter. Usual dots, black. Subdorsal lines, with a fine darker upper edging, very obsolescent. Spiracles, black; below them, a paler ochreous ground. Thoracic plate, now brown, with the three dorsal lines marked in white. Head, ochreous grey, freckled with brown.

Feeds on low plants at night, hiding by day in crevices, etc. In a state of nature, overwinters.

The imago flies in October at 5000 feet in Fars.

Meganephria renalis Wilts = **crassicornis** Brandt. (Plate II, Figures 11, 12).

I do not yet know which of the above names is prior.

Larva:—Very variable. Not unlike the larva of *oxyacanthae* L. The neck is orange, as in the genus *Nychiodes*, with four black transverse spots forming a dorsal collar. The colour is usually brown, freckled with blackish, and sometimes frosted dorsally with white. There is a continuous chain of dorsal diamonds opening one into the other, sometimes very distinctly marked in black. The dorsal line is diffuse, brownish, grey-edged. On each somite the four principal dorsal and two lateral setae are whitish, black-ringed; other dots, black. A heavy blackish oblique lateral shade on somite 4. Spiracles, pale, black-rimmed. Below them, a black sublateral line which zigzags parallel to the subdorsal line, and has a vaguer paler upper edging. On somite 10 the posterior edges of the dorsal diamond are blacker than elsewhere. On somite 11 are two prominent hair tipped dorsal points marked with black on each side. On somites 12 and 13, a blackish Y. Underside, paler. Head, large, square, with rounded red-brown-tinged upper corners, light brown, with purple dots and black markings, the inner edges of the two lobes being deep black, so as to form two converging whitish-edged almost straight black 'S's which do not quite meet in the upper centre of the face.

Foodplants:—*Amygdalus*, *Prunus*, *Crataegus*.

It feeds at night, but often rests by day among the upper branches. At 3000 ft. (e.g. Shapur gorge) some larvae are full-grown in early March; higher up, the larvae have all matured by the beginning of May. At 6000 ft. the imago flies in November; lower down it flies later, no doubt.

Brachionycha atossa Wilts. (Plate II, Figure 6).

Ova, laid loose, or higgledy-piggledy; ivory-white, bun-shaped, slightly glossy finely but fairly strongly sculpted, with a very fine black apical dot.

Larvae, when freshly hatched, grey with prominent setae, whitish lateral stripe and speckled ochreous head. Second instar:—blue-green, with black setae, ochreous head, and white dorsal, subdorsal and sublateral lines, the latter being wide stripes. Third instar:—dorsal and subdorsal lines, fine and white; spiracles, black-rimmed, placed on a broad conspicuous white stripe. Head,

yellow-green. At this stage the resting position is with head curled downwards. In its final instar, the head is thrown backwards, so that the larva resembles a curled leaf. It is now plump, apple-green, sluggish except if exposed to direct sunlight, and slightly humped on somite 11. The dots, dorsal and subdorsal lines are yellowish. The broad sublateral stripe is yellowish and edged above with crimson-lake. Head, green, with a yellow inverted V on the face; thoracic hood, yellow edged in front. The white black-rimmed spiracles are just above the sublateral or spiracular stripe. Underside, with a faint yellow-green ventral line.

It feeds at the same time and places as the *Meganephria* species described above. Foodplants: *Acer*, *Prunus*, etc.

It proved impossible to photo the characteristic resting-position of this larva, since these photos were taken by sunlight (except for one of *auceoudi* which was taken by lamp-light) and *atossa* larvae invariably rest in the shade of a leaf, avoiding direct sunlight. The figure shewn, therefore, is of the larva trying to move into a shady place.

***Eumichtis muscosa* Stgr. (Plate II, Figure 10).**

This species is perhaps the same as the later *rasilis* Draudt.

Ova, bun-shaped, ivory-white at first, later with a brown apical dot and ring, strongly sculptured. Laid in small strings or batches. Period, seven days.

Young larva, glossy brown with black tubercles and light bristles. Later:—brown, with a rather vague darker grey-brown pattern. Dorsal line, dark, double, darkest at ring-joints, which are darker. Subdorsal lines, paler, vague, dark-edged, with short longitudinal bars close to the black setae, one on each somite. Spiracles, white, black-rimmed, placed just above a not very conspicuous whitish spiracular stripe; next to each spiracle, a black tubercle. The area above the spiracular stripe is rather dark and cloudy, but below it much paler and greyish. Head, brown, marked with two blackish lines on top.

Of larvae hatching from ova laid in mid-October, the first pupated, in captivity on December 20th; but this speed of growth was doubtless due to forcing, and in a state of nature the larva doubtless feeds throughout the winter, at a slower pace. They fed on various low plants, especially dandelion.

***Atethmia xerampelina* subsp. *pallida* Stgr. an sp. dist. (Plate II, Fig. 4).**

Not having examples of the European *xerampelina* larvae for comparison with the Persian *pallida*, I sent a skin of the latter to Dr. Cockayne, who replied to me:—‘I have compared it carefully with six British *xerampelina*, all of which agree exactly with one another. The notable difference between these and *pallida* is the dorsal line. In *pallida* it is narrower but complete and bordered throughout by a narrow black line, whereas in British *xerampelina* it is broader and broken up and not bordered by the black line. The pale neighbouring areas of ground colour give it a very different appearance. Apart from this *pallida* is less pigmented. The thoracic plate in . . . *xerampelina* is largely black, but in *pallida* it has only a narrow black edge. The head and anal plate are less pigmented. There is no pigment on the legs of *pallida*, but on the legs of British *xerampelina* pigment patches are present. The venter of *pallida* is very transparent, but it has a denser and greyer tone in the British *xerampelina*. The black supraspiracular line is thicker in British *xerampelina*. If these differences are constant it seems to me that *pallida* is a closely allied species.’

In the three skins retained by me here in Iran, there is no variation, all resembling that sent to Dr. Cockayne, so it seems very possible that *pallida* is a good species. Its larva feeds not only on ash, but on the cultivated almond, biting holes in the flower-buds in spring-time. At Kermanshah I found that the ash-feeding larvae were a week or two in advance of the almond-feeders. They hide by day in the ground.

At Kermanshah the larvae were full-grown in March. The imagines fly in October. Kermanshah, Tabriz, Shiraz.

***Oncocnemis iditoglypha* Brandt (Plate II, Figures 5, 7, 8).**

The larva has two well-differentiated forms:—

1. green form:—green with a brown head, and a white spiracular stripe which has a pinkish upper edging. Spiracles, white or yellowish, black-rimmed. Joints, yellowish. Somite 11 has a double prominence. On closer inspection

a number of very fine wavy whitish lines can be detected on the back. (Figure 5).

In earlier instars the head is green.

2. grey form:—grey, with a double white dorsal line, forming a series of backward-opening whitish V-marks. Subdorsal lines, black, interrupted. On somite 11 a double prominence. Spiracles, white, black-rimmed, placed between two white lateral lines which tend to converge forward and are edged with black on somites 4 and 5; posteriorly these two lines are separated by grey shades. Above the feet are two faint white wavy lines. Underside, pale grey.

Foodplant: *Lonicera persica*. It refuses cultivated honeysuckle in captivity.

The larva is slender, and of a lively habit.

Pupa, red-brown, fairly thin-skinned.

The larvae may be beaten in numbers from the honey-suckle trees of the high mountain scrub woods of Fars; the imago is out in July and August. The foodplant is not found below 6000 ft., but above this height the moth appears to be widespread.

Scythocentropus cyrus Brandt.

Larva, at first bright green, with a yellow sublateral stripe. Later, olive brown, with many fine yellow lines and a conspicuous broad yellow sublateral line. The head and first somite are dotted with black. Spiracles, pale brown, black-rimmed. In well-marked examples, there is a darkening of somite 11 dorsally, and a slighter darkening of the dorsal stigmata on somite 10 and also of the subdorsal line.

Foodplant, *Fraxinus* in the high forest at Pir-i-Zan, Fars; another species of ash grows commonly in gardens along water-channels at 4000-6000 feet, but this moth does not seem to occur in these localities. It may however feed on other trees in the forests, such as *acer*. It is very lively, and grows quickly. A larva full-grown in early June produced an imago in August; the pupal stage therefore seems to be longer than in other quick-growing species which emerge in midsummer.

Elaphria bodenheimeri Drdt. (Plate II, Figure 3).

The larvae here described were bred from ova laid in Fars on 11 and 12-iii-41, by a female of the Persian race *plesiarchia* Brsn.

The ova were bun-shaped, yellowish, finely but clearly sculpted; later a pink-brown apical ring and dot developed. Period:—10 days.

Soon after hatching the young larvae assumed a striking orange-brown colour. Later:—brown. Dorsal line, a series of disconnected pale lozenges, each bisected by two fine dark cross-lines. A darker dappled shade joins these lozenges together. Subdorsal lines, paler, edged on both sides with darker brown. Spiracles, black, placed on the border between the brown dorsal area and the paler greyish ventral area. On each somite above the spiracle is a pale hemispherical bledge. Head, pale brown, dark round the edges.

In captivity the larvae fed readily on *Calendula*.

Cocoon, among litter, firm, fairly roomy.

From these pupae, two imagines emerged on 2 and 3-vi-41, while the others hatched in the autumn, but in a wild state there are only two broods, a spring and an autumnal.

Enargia badiofasciata Drdt. (Plate II, Figure 9).

Ova, bun-shaped, ivory, sometimes green or yellow tinged, laid in twos and threes. Period, 18 to 30 days.

Larva, very unlike its congener *abluta* in aspect and habit. (For the sake of comparison I include in the plate a photo of the larva of *Enargia abluta* Hbn., as found feeding on poplar in the Elburz mountains. The protuberant lobes of the head are conspicuous, and the habit is to live between spun-up leaves on its host-tree:—(figure 13) *Badiofasciata* larvae are grey-brown finely freckled with black. The dorsal line is represented by a series of white spear-heads, joined by a fine, pale, but, except on the thoracic somites, less white line. Usual dots, white, black-centred. Subdorsal lines, whitish, black-edged above. Just below the inconspicuous, brown, black-rimmed spiracles is a wide wavy whitish lateral stripe with a brownish centre, and above it a series of blackish shades each surmounted by a white mark. Head, brown, freckled with black. Anal plate, blackish brown, with dorsal line marked in

white. Thoracic plate, paler brown, with dorsal and subdorsal lines similarly marked. Underside, grey-brown. Head, not prominently lobed.

Feeds on low plants at night; in a wild state over-winters. Larvae kept in a warm room were full grown in January, but then entered a state of coma, not pupating until March. The pupal stage lasts till the autumn.

Pupa, pale brown.

(The pupal stage of *abluta* in Persia lasts only a month, the imago emerging at the beginning of July.)

I doubt whether these two species should really remain in the same genus.

Catocala lesbia Christ. (Plate II, Figure 14).

This larva has less whiskery trousers than its congeners; or, to use more scientific language, the sublateral hairs, so typical of the genus, are unusually scanty. At a first glance the larva might be taken for an *Ophiura* or *Pandesma*. It can, however, easily be distinguished from that of *Pandesma anysa* Guen., which feeds on the same tree in similar localities, by the interruption, on the 4th somite, of *anysa*'s broad whitish dorsal stripe. It also grows exceedingly fast, and has two, perhaps more broods in a year. I regard it as the descendant of a more primitive type of *Catocala* than most of the other species of the genus. Vide my article, *The phenological classification of Palearctic Lepidoptera* Ent. Rec., Oct. 1941.

Larva, pink-brown, or grey. Dorsal stripe, broad, pale, continuous, grey-centred. Lateral stripe, similar, but with more irregular borders. Intervening areas, darker grey. Spiracles, dark grey, black-rimmed; below them, a wavy paler stripe. Head, outlined with black. An oblique black line runs forward down from a pale cross-bar on the back of somite 11. Underside, pale, with big black spots between the claspers. There are a few pale bristles just above the claspers.

The larva spun up on 27-iv-41 but only pupated on 5-v-. The moth hatched on 2-vi. I have also taken it in the late autumn.

Pupa, purple brown; with a pale lilac bloom. Length, 3.5 cm. Cocoon, roomy, papery.

Clytie distincta B-H. ssp. *iranica* Brandt. (Plate II, Fig. 16).

Immature larva, slender, green, with continuous white longitudinal lines. Head, as in the green form of *Clytie delunaris* (vide the third article in this series, *loc. cit.*).

Mature, slender, ochreous brown or grey, whitish underneath.

Somite 8 is slightly swollen and darkened dorsally, while somites 11 and 12 have two double dorsal prominences, those on the latter being slighter. Markings, mottled blackish grey. On somite 4 the subdorsal dot typical of the larvae of this genus is accompanied by a blackish shade. On each of the somites 1-10, there is a whitish mark close to the usual subdorsal dot. Dorsal line, discontinuous, consisting of grey disconnected spear-heads, pointing backwards. Lateral line, pale grey. Head, grey brown, marked with blackish. Spiracles, pale, black-rimmed, inconspicuous.

Foodplant:—Tamarisk.

Pupa, red-brown, without bloom. Can be found in branchforks or under bark, of the big tamarisk trees at Bushire. From larvae full-grown in February and March, imagines hatched in April. I should expect it to have repeated broods all the summer, as is the habit of its congeners, but cannot confirm that this is so.

Gnophosema palumba Brandt. (Plate II, Figure 23).

Ova: long-oval, grey-green, glossy; sometimes in ones and twos, but more often laid in straight strings of three to eight eggs. Period (in June):—one week.

The freshly hatched larva is grey with a black head. Later it becomes a very remarkable green 'stick-caterpillar', exactly harmonising with the stems of its foodplant, on which it rests by day usually straight along the stem, but sometimes forking from it like a short twig. It feeds at night. It is smooth and green, with a purple bifid head and a pair of less prominent yellow points just behind the head on somite 1. The face is pale lilac; the claspers and thoracic feet are purplish. On s. 5 are ventral (and sometimes dorsal) purple marks, and on somite 9 a purple dorsal dot.

Foodplant:—*Amygdalus spartioides*.

It feeds slowly but the pupal stage in June is brief.

Pupa:—purplish, heavily freckled with blackish.

The larva may be found during winter at about 3000 feet in Fars, or in early summer at higher elevations. There are at least two broods.

Somatina Wiltshirei Prout.

Larva:—long, slender, pale brown, $1\frac{1}{3}$ inch long, with a rather complicated pattern of grey dots and marks. Dorsal line, pale, grey-edged, interrupted by short grey cross-bars or v marks, and dotted on somites 3, 4, and 8. Subdorsal lines, pale, grey-edged, interrupted; lateral lines, similar. A grey sublateral shade on the fore-part of each somite, sometimes blackish on the thoracic somites. Joints, paler, or grey-marked. Somites 4-8 also have rather large whitish sublateral marks. Underside, grey-suffused, with wavy grey lines.

Habit:—between strides it sways laterally from the hind claspers.

Foodplants:—*Fraxinus* and *Acer*, probably other trees also, in the Zagros forest.

Pupal period, eight to fifteen days.

Cocoon:—oval, large and roomy, loosely woven amid leaves and litter. The larva matures about midsummer, and the imago flies from July to October; perhaps there are two generations.

Scopula beckeraria Led. (Plate II, Figure 15).

Ova, laid singly or in clusters, on end: first greenish yellow, then coral pink, dotted with darker red; finely sculpted longitudinally.

Larva:—slender, yellowish green until half growth, then putty-coloured. Skin, transversely wrinkled. Dorsal line, very faint except on the last three somites, where it is fine, white and grey-edged; the white centre is less apparent on the other somites. On the anterior part of each of the four most elongated somites is a pair of distinct grey dorsal marks. The dorsal line is also grey-marked on somites 11 and 12, especially when half-grown. Spiracles, black. Head, pale, with faint grey markings. Somite 11 terminates in a pointed dorsal flap bearing a pale bristle, somewhat like the lip of the anal orifice on somite 12; somites 9 and 10 have a similar bristle only, and, indeed, the other somites are similarly equipped with dorsal bristles. Feet and claspers, pale. Underside pale; lines, obsolete. Lateral ridge, slightly obfuscated.

The larvae bred during the summer of 1939 were full grown about six weeks after the laying of the eggs from which they hatched. There are two regular broods, a spring and an autumnal; apparently also there is a mid-summer flight, at least this is so in Fars, at about 6000 feet.

Triphosa taochata Led. (Plate II, Figures 17, 18).

German collectors in the Middle East have speculated whether this was not only a race of the European *sabaudiata*. It is certainly a close relative, but the larva shows such definite differences from the descriptions of the latter to which I have access that I incline to regard it as a good species.

The young larva is plump, lazy, apple-green, glossy; the dorsal line is darker green and probably subcutaneous. Stigmata, whitish green. Spiracular line, conspicuous, creamy white, joining across the rounded lip of the anal orifice. Spiracles, very conspicuous, whitish, dark-rimmed. Head, small, pale green, shielded by a hood-like thoracic plate. It feeds by night, resting by day among the leaves where it is quite invisible. By day, however, large numbers can be beaten out of very small bushes. (Fig. 17).

When mature, the larva is dark olive brown. The head is pale brown, dappled with black, not remarkably glossy (i.e., very unlike that of *sabaudiata*). Dorsal area, usually darker brown but sometimes paler; in it the complete dorsal line and the interrupted subdorsal lines are marked lightly in black, while the lateral stripe, in all forms, is very heavy black. Below the lateral stripe is a pale yellowish area, marked with parallel lines after the same fashion as the dorsal area. This lateral area is edged below with a less heavy black edging consisting of a series of dashes each thickened on the anterior part of the somite. Spiracles, pale, black-rimmed. Setae yellow, black-circled. It rests by day on the lower stems and can there be found by searching. (Fig. 18).

Foodplant :—*Rhamnus*.

At 5000 feet in Fars it pupates in April and produces imagines in May. Higher in the Persian mountains, the imagines fly in June, and even later. It also occurs at 2000 ft. in early summer in Iraqi Kurdistan.

***Abraxas wehrlii* B-Salz and Brandt.**

When young, the larva's ground colour is pale green, and the longitudinal lines are discontinuous; but in the last two instars the larva is yellowish white with thick continuous black lines (one dorsal, two subdorsal and two lateral on each side, and two sublaterals on each side below the spiracles). Spiracles, black. The lower lateral line is partly interrupted above each spiracle. Under-side, yellow-white. The head, thoracic plate, glossy anal plate, and all the last somite are orange-brown; the anal plate is edged anteriorly with a black transverse band, but only in the last instar. Thoracic feet, orange, marked with blackish. First pair of claspers, lightly marked with brown.

Foodplants :—*Fraxinus* and *Acer*, in the Fars forests at over 6000 ft. The species does not occur among the ash-trees of the gardens of Persia.

Pupa :—light red-brown, glossy, in a slight cocoon among litter on the ground.

Larvae full-grown in late August produced imagines in mid-September. The first brood flies at the end of May and in early June, both by day and at night. It is extremely numerous during its brief season of flight.

***Epitherina rhodopoleos* Wehrli. (Plate II, Figure 19).**

Ova, oblong-oval, rather large for the size of the imago, rather narrower at one end, purplish pink, glossy. Period :—two weeks.

Larva :—freshly hatched, yellow-grey, with brownish mouth and alimentary canal. Later :—green, yellowish at joints, with white subdorsal lines, and some other very faint yellowish lines, and two faint white ventral lines. The upper lip of the anal orifice is marked with purple. The colour is sometimes quite bluish green.

Foodplants :—*Amygdalus*, *Prunus*, *Crataegus*.

The imago flies in Fars as early as February at 3000 ft., and as late as April at 6-7000 ft. The larva feeds up and pupates in early summer.

THE GENUS *NYCHIODES*.

Perhaps the most extraordinary fact of Brandt's discoveries in Fars in 1937 was the introduction of six new species of *Nychiodes*, a genus of which till then hardly more than that number of species were known; furthermore, none of the known species were recorded from Fars, nor have I found any of them there either. Evidently this genus is a speciality of the Southern Zagros; evidently too it is both vigorous and sensitive to environment, easily forming new species in its haunts.

Of Brandt's six new species I have been lucky enough to breed four; I partly describe the larva of a fifth, previously known, species here also. All these larvae resemble each other in having sluggish habits, a fondness for arching the body, three more or less developed pairs of dorsal spurs on somites 5, 6 and 7, and an orange collar. All, too, seem attached to *Amygdalus* and *Prunus*. I found none, however, on the common Fars tree *Amygdalus spartioides*, which has smooth glossy green stems with very few leaves; on this they would be conspicuous; the geometrid larvae I have found on this tree were all green, smooth, and held themselves straight. *Nychiodes* larvae are, however, impossible to detect in a dense, twiggy bush such as is provided by the other two species of *Amygdalus* (probably *horrida* and *eburnea*, the latter being the robuster) and the *Prunus*, on which they also feed.

***Nychiodes variabilis* Brandt. (Plate II, Figures 28, 30, 31).**

As the name denotes, the imago is very variable; but so also is the larva.

The ova are at first green, then reddish grey. Period; about a week.

The young larvae are ochreous, the dorsal area being darker on the posterior somites. The spurs are blackish.

When full-grown, the pair of spurs on somite 6 is usually considerably larger than those on 5 and 7; when well developed, these spurs are conical, fleshy, slightly retrorse, and a similar smaller pair occurs on somite 11. But later in the season these spurs fail to develop, so that the larva, in this respect,

hardly differs from that of *subfusca* (vide sub); the spurs are best developed in the larvae that have hibernated.

The markings vary too:—the colour may be pale grey, blackish, or bright purple. The purple form usually has two white subdorsal lines and the dorsal area is considerably suffused with white too. The black dorsal line is interrupted on somites 5 to 8 and accompanied on either side by a dark zigzag line. The spiracles are black-rimmed. Curious to relate, the entire brood of larvae reared from a female taken in mid-June on the Muk Pass, Fars, were of this form, and in all these larvae the dorsal paired spurs were obsolescent. Figure 30 shews one of these larvae. Figure 28 shews a similarly coloured and marked larva, taken earlier in the season, in which the spurs are better developed.

The black and grey forms however lack the white lines and suffusion of the purple form, but they may have the spurs equally undeveloped. The dark form is light grey heavily speckled with black; head, dark grey; dorsal area, dark grey. Spiracles, black, set in a dark area and preceded by an oblique dash usually orange-tinted. Anal somite, white-marked. Somites 7 and 8 are pale grey laterally, and a dark zigzag line borders the dorsal area. In the paler grey form, somite 8 is pale dorsally too; behind each pair of spurs is a whitish, black-edged triangle, pointing backwards. The dorsal markings are clearest on somites 4-7 and consist of an X on each somite except the eighth and the thoracic somites. (Figure 31).

The first brood emerges in May and June; the second brood is partial, only some of the larvae feeding up quickly.

As for the form *leviata* Brandt, I regard this as a mutation, not a distinct species. I must confess that I have not bred it from one parent together with the more ordinary form; but I have bred it from larvae which seemed identical. I might add that I can only recognise *leviata* as distinct in the male sex. Until both forms are reared from a single parent, however, these opinions cannot be considered proved.

Foodplants:—*Amygdalus*, *Prunus*, *Crataegus*.

***Nychiodes subfusca* Brandt (Plate II, Figure 24).**

Ova, long-oval, light brown with a green interior, and darker brown longitudinal ridges. Period, ten days.

Larva:—more monotonously coloured than *variabilis* and equipped with a greater number of small spines; in the generation bred, the paired spurs typical of the genus were reduced in size in the last instar; this was a second generation of larvae, some of which fed up quickly and produced a second brood of imagines in August.

In the second instar the larvae is pale grey with blackish head and white warts and a white sublateral area edged above with a thick zigzag purple line. The paired spurs in this stage were short and fleshy, those on somite 6 being more prominent. Behind the head are a number of conspicuous small spines, and the white warts are spine-like in form. On somites 1-7 there are dark dorsal cross-bars and shades. Third instar, similar.

Last instar:—pale grey more or less heavily dappled with blackish grey, especially on the head. Dorsal area of somites 1-7, darker grey, with three black transverse bars on somites 5, 6 and 7 behind the paired spurs. Dorsal line, grey, with fine darker edges; subdorsal lines, wavy, interrupted. The spurs are still fleshy but now very short, the pair on somite 6 being scarcely more prominent than the others. (Whether this is so in the hibernating, first brood larvae, I do not know.) Below the spiracle on somite 4 is an oblique black bar. On somite 1 a black lateral mark above the spiracle extends forward onto the head, which has an interrupted fine black crossbar on top just in front of the orange collar. Spiracles, purple brown, black-rimmed.

Foodplant:—*Amygdalus* and *Prunus*.

Pupa:—red-brown, glossy, with slightly prominent face; in a slight cocoon under leaves.

The first brood comes to light in mid-June at 7000 ft. in Fars. Much less common than *variabilis*.

***Nychiodes divergaria* Stgr. (Plate II, Figure 25).**

Small larvae of this species were found at night in November 1937 on old apricot trees in a Bagdad orchard. A few weeks later duty took me to Tabriz, whose winter they did not survive. I cannot therefore describe in detail the

mature larva, but I give a photo of a half-grown larva, from which it can be seen that it somewhat resembles that of *variabilis*, with the spurs on somite 6 well developed. The species occurs in Kurdistan, and a very unusual race has been described from the Elburz mountains.

***Nychiodes farinosa* Brandt. (Plate II, Figures, 20, 29).**

This rare species seems to be the only one of the species occurring in Fars to inhabit orchards; the others inhabit the scrub-clad mountain-sides. It is only known from the mountains round Ardekan; I have taken specimens in the gardens of Ardekan (7000 feet) in late June.

The rather large ova are laid in a batch, are pale green, but turn pinkish-grey on the second day.

Larva, freshly hatched:—pale greenish grey, with black sublateral marks between the thoracic feet and claspers. Head, brown, marked with black.

Second instar:—yellowish green with paler warts and bristles; brown head; no other dark markings.

Third instar:—pale greenish white, with a whitish lateral stripe. Head, at first pale green-white, then yellow-brown, later dark brown. In mid-August the larva, still in this instar, began to develop a brown tinge in parts, the paired spurs on somites 6 and 11 becoming notably brown. On August 30th the larva was about $\frac{1}{2}$ inch long, and was green, tinged with brownish, except for the anterior edge of somite 1 which was pale yellow-white. Spiracles, black-rimmed. On somite 1 a fine oblique lateral line behind the head, just above the spiracle (pointing backward-downwards); another fine oblique blackish lateral bar on somite 4 (pointing forward-downwards). The paired spurs on somite 6 are well-developed, straight, almost cylindrical, but broader at their base, red-brown in colour; those on somite 11 are similar, but retrorse and somewhat smaller. On 5 and 7 however there are two equally developed smaller pointed warts on each somite. Head, knotted, dark-brown, edged with black close to the collar; the orange, typical of the genus, is hardly perceptible here. A brownish interrupted dorsal line can be traced, and there is a certain amount of brownish low down on the sides. Figures 20 and 29 show larvae both in the third instar, but the former is of the green form, while the latter shows the appearance of the brown, hibernating larva.

I was obliged to leave Iran in March 1942 and was therefore unable to complete the life-cycle of this species.

This larva from Ardekan ova was bred in Shiraz and Isfahan on cultivated kinds of *Prunus*. It showed no inclination to grow fast and produce a second generation. Hibernation began in November, in the 3rd instar.

***Nychiodes admirabilis* Brandt. (Plate II, Figures 21, 22).**

This beautiful species is common among the large almond bushes 6-8000 feet high in the Fars mountains. The larva however is hard to breed in different surroundings.

The Swiss entomologist Dr. Wehrli wrote to me that its peculiar structure justified the erection of a new subgenus for it; the larva also diverges strikingly in form from its congeners. The paired spurs on somites 5, 6, 7 and 11 are remarkably developed, as shown in the photos, and those on 5 and 7 are practically equal in size to those on 6.

Ova:—large, oval, pale putty-coloured, laid in twos and threes, in strings; in crevices. There is no great change in colour.

Larva, freshly hatched:—pale ochreous, marked with brown. Head, with two black spots. Spurs, black. A week later black lateral spots were noted on somites 6, 7 and 8. Later, it becomes grey dappled with rusty brown. When half grown (Figure 22) its distinctive form is already marked: purple-grey, with three pairs of prominent orange-coloured fleshy, almost bulbous, spurs on somites 5, 6 and 7, and a similar smaller pair on 11. White lateral marks on somites 4-8, and a pale lilac dorsal suffusion on somites 8 and 9; head, distinctly knotted, its two points being brown; on the face, four horizontal white bars. The pale suffusion extends as the larva grows larger. Figure 21 shews a full-grown larva just before pupation; at this stage nearly the whole larva is whitish grey suffused: the twig-like spurs now seem less bulbous and are dark grey, the anal pair being retrorse and joined at the base. Spiracles, white, black-rimmed. The spiracle on somite 4 is placed in a grey-brown blotch and below a black wart. There are blackish warts on somites 5, 6 and 7 just below the spiracles. On somite 10 there is a short

oblique blackish bar below the spiracle. The thoracic feet are orange, and there are two short grey black-edged oblique bars, separated by a white bar on the side of each of somites 2 and 3, just above the feet. Head, whitish brown. Somite 1 has five pairs of short black spines or pointed warts on its anterior edge just behind the orange collar. There are no lateral orange marks.

Pupa:—dark red-brown, with long pointed cremaster. Period, twenty-six days.

One larva, from ova laid in mid-June, attained full growth at the end of August, which shows that a second brood is possible.

Imagines from Muk Pass (due south of Shiraz) are a sootier, greyer race than those flying north and west of Shiraz, and I suggest the name *safidaria* ssp. n. for them, after the Safidar range which begins southward from the Muk Pass. The types of this new race are in my collection and were taken in profusion on 15-6-41 at 6500 ft., to light.

Gnophos hoerhammeri Brandt. (Plate II, Figure 26).

A protuberance reminiscent of an *Ennomos* larva distinguishes this larva from most of its congeners; presumably its close relative *stevenarius* Bsd. has a similar structure, but I have not bred the more widely distributed species yet.

Larva:—pale grey, darker on somites 1-3 and 9-13. On somite 4 a short black cross-bar marks the posterior somital joint. Somite 5 has a similar bar behind four prominent warts coloured darker grey. Somite 6 bears two large black sublateral protuberances and a transverse dark bar underneath. Somites 9-11 each bear a pair of conspicuous black setae. Head, small, dark grey. Subdorsal lines, whitish just behind head. On somites 4-8 are five short oblique dark lateral bars. Sometimes the larva is considerably suffused with black.

Foodplant:—*Amygdalus* (?) *eburnea*, but fed on the cultivated species in captivity.

Pupal period. in early July, eight days.

Gnophos dubitarius Sigr. (Plate II, Figure 27).

Ova:—oval, slightly flattened, pale green, then pinkish grey; laid flat, singly or in irregular batches. Period, in March, 20 days.

Larvae, freshly hatched: dirty white with broad dark brown subdorsal stripes. Later:—pale olive, with heavy olive-brown arrow-heads, pointing backwards, on each side, especially dark on somites 4-8. Dorsal line, very faint, scarcely continuous, olive brown. Setae, pale, prominent. Below the black spiracles begins a darker olive brown ventral area. Feet, of this colour or rather paler. Movements, slow, jerky; pose:—arched; if disturbed, shakes.

Foodplant:—*Polygonum*, etc.

The larvae grew up in about eight weeks and pupated in mid-June in slight oval cocoons.

Pupa.—light brown.

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 E. P. Wiltshire:—New Lepidoptera from S. W. Iran. *Journ. Bombay Nat Hist. Soc.* Aug. 1941.
 The last of these three works gives a brief description of the characteristic vegetation of Fars, which will be of service to readers of the present work.

EXPLANATION OF PLATES TO ILLUSTRATE 'EARLY STAGES OF ORIENTAL PALEARCTIC LEPIDOPTERA—V'—by E. P. Wiltshire.

PLATE I.

- Fig. 1.—*Aporia crataegi* L. larva. (Fars).
 Fig. 2.—*Melanargia larissa* Hubn. larva. (Fars).
 Fig. 3.—*Thecla abdominalis* Gerh. *gerhardti*. Riley. two larvae. (Fars).
 Figs. 4, 9.—*Cerura syra* Gr-Gsh. larvae. (Lebanon) (9 is a white-suffused form).

- Figs. 5, 10.—*Cerura turbida* Brandt. larva. (Fars).
Figs. 6, 14, 15.—*Onceria audeoudi* Brandt. larvae. (Fars).
Fig. 7.—*Malacosoma castrensis* L. *kirghisica* Stgr. larva. (Fars).
Fig. 8.—*Lymantria amabilis* Chr. larva. (Fars).
Fig. 11.—*Portheia melania* Stgr. larva. (Fars).
Fig. 12.—*Eriogaster amygdali* Wils. larva. (Fars).
Fig. 13.—*Cerura* sp. larva. (Tehran).
Fig. 16.—*Agrotis singularis* Koll. larva. (Fars).

PLATE II.

- Figs. 1, 2.—*Agrotis jacunda* Drdt. larvae. (Fars).
Fig. 3.—*Elaphria bodenheimeri* Drdt. larva (Fars).
Fig. 4.—*Atethmia pallida* Stgr. larva (Kermanshah).
Figs. 5, 7, 8.—*Oncocnemis idioglyphia* Brdt. (Fars). (5: green form larvae.
7 and 8, grey form larvae and foodplant).
Fig. 6.—*Brachionycha atossa* Wlts. larva (Fars).
Fig. 9.—*Enargia badiofasciata* Drdt. larva (Fars).
Fig. 10.—*Eumichtis muscosa* Stgr. larvae (Fars).
Figs. 11, 12.—*Meganephria renalis* Wlts. larvae (Fars).
Fig. 13.—*Enargia abluta* Hbn. larva (Elburz).
Fig. 14.—*Catacala lesbia* Christ. larva (Fars).
Fig. 15.—*Scopula beckeraria* Led. larva (Iran).
Fig. 16.—*Clytie distincta iranica* Brdt. larva (Bushire).
Figs. 17, 18.—*Triphosa taachata* Led. young and mature larvae (Fars).
Fig. 19.—*Epitherina rhodopolea* Wli. larva (Fars).
Figs. 20, 29.—*Nychiodes farinosa* Brdt. immature larvae (Fars). (Fig. 20 $\times 2$,
as on 30-8-41; Fig. 21, during hibernation 1941-42).
Figs. 21, 22.—*Nychiodes admirabilis* Brdt. larvae (Fars). (Fig. 22: a half-grown
larva).
Fig. 23.—*Gnophosema palumba* Brdt. larva on food-plant (Fars.).
Fig. 24.—*Nychiodes subfusca* Brdt. larva (Fars.).
Fig. 25.—*Nychiodes divergaria* Brdt. immature larva (Bagdad).
Fig. 26.—*Gnophos horhammeri* Brdt. larva (Fars.).
Fig. 27.—*Gnophos dubitarius* Stgr. larva (Fars).
Figs. 28, 30, 31.—*Nychiodes variabilis* Brdt. larva (Fars.).

(N.B. The figures in the plates are considerably, but not uniformly, enlarged).

FISH-EATING BATS OF INDIA AND BURMA.

BY

DR. E. W. GUDGER.

Honorary Associate in Ichthyology.

American Museum of Natural History, New York City.

(With 1 plate and 4 text-figures).

To many readers the title of this article alleges a perfectly preposterous manner of life for these winged mammals. All dwellers in temperate regions know their bats to be insect-feeders and it is a logical presumption that those of tropical India and Burma are also insectivorous. There are good reasons for believing that all bats in their earliest history were insect-feeders. This is evidenced by the fact that by far the greatest number of species living today are insectivores. However, there are in both the Old World and the New many forms which have fallen from grace and have become vegetarians—fruit-eaters. Then there are some few species which seem to be 'middle-of-the-road' or transitional forms in their manner of feeding. Departing still further from the primeval mode of life are certain American bats which catch and eat fishes, while in India and Burma bats of one genus are known to feed on various vertebrates, including fishes.

Now, since bats are nocturnal animals and do their feeding at night or at best at twilight, observations of their fish-catching are made with difficulty. As a result, the proofs of this most unusual habit have been accumulated slowly and stumblingly.

Apparently no one has as yet seen any Old World bats in the act of catching and eating fishes—we have only allegations. One set of these, however, indisputably establishes the fact that certain Indian bats do eat fishes, the other falls to earth. The accounts published by the alleged are widely scattered and are buried in technical books and journals. I have had much pleasure in digging out these accounts and putting them in order for this article. If the reader finds herein something of that pleasure, I shall be repaid.

INDIAN FALSE VAMPIRE BATS CATCH AND EAT FISHES.

The first of the accounts now to be given is interestingly enough the first recorded intimation that any bat anywhere in the world ever caught and ate a fish. It was published nearly one hundred years ago in the body of a technical article bearing a very non-informative title, as the bibliographical reference (Blyth, 1844) shows. Here it long remained securely hidden from all but a little handful of students of Indian bats—all of whom quoted the fact without giving the

source. But thanks to long practice in running down obscure references, I finally traced it to the original publication.

This bat, *Megaderma lyra*, which is widely distributed throughout India, belongs to the insectivorous group but because of its carnivorous habits is called the false vampire bat. Its name, *Megaderma* (large skin), is possibly given in allusion to its enormous ears, so prominent in the picture of its head. It is called a false vampire because, while it does not suck the blood of man (as the American vampire is known to do), it has been shown that it feeds on various small vertebrate animals. Its feeding on a smaller bat was vividly described as early as 1842 by Edward Blyth from a personal observation. Furthermore this attack was begun while both bats were in the air and was concluded after both had been put in a cage. Since then the Indian vampire has been found to prey also on small birds, on mice and on lizards. In feeding on bats, it first sucks their blood and then eats the flesh.

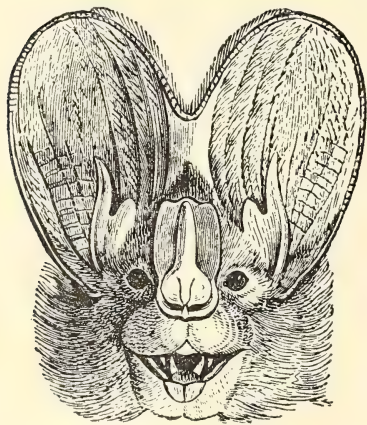


Fig. 1.—Head (front view) of *Megaderma* (big ears), the Indian false vampire bat—the first bat ever convicted of fish-eating.

After Sterndale, 1884.

The picture of the head drawn in front view (fig. 1), with its huge ears and their bipronged lappets, the staring eyes having between them the curious fleshy nasal appendage, and especially the prominent sharp-pointed canine teeth, portrays a nightmarish animal which, if it were larger, one would not care to meet in the dark. In an animal with such an aspect, one might expect the bloodthirstiness indicated above. Furthermore, from our point of view there is evidence that it also feeds on frogs and fishes. Yet *Megaderma lyra* is a small bat, with head and body only three to four inches long and a wing-spread of fourteen to nineteen inches.

In 1844, Blyth received from Mr. Frith a letter in which evidence was given that this bat eats fishes. Frith (about whom I have no information) had read Blyth's earlier account of the cannibalistic predilections of the Indian vampire and wrote Blyth of his own observations. Blyth published this information as follows:

Mr. Frith informs me that a number of these [Indian false vampire] bats (*Megaderma lyra*) were in the habit of resorting to the verandah of his residence in Mymunseng, and that every morning the ground under them was strewn with the hindquarters of frogs, and the wings of large grass-hoppers and crickets: on one occasion the remains of a small fish were observed; but frogs appeared to constitute their chief diet—never toads: and on a quiet evening these animals [bats] could be distinctly heard crunching the heads and smaller bones of their victims.

It may be remarked just here that other Indian false vampire bats seem to like to associate with man—as is seen in their well-known habit of bringing their prey to the verandahs of houses and

even into the houses, and there devouring it while hanging by their hind feet to the wall or to the cross timbers. That the Indian vampire is entirely capable of 'crunching' the heads and smaller bones' of its fish prey is readily understandable when one sees the strong jaws and pointed teeth portrayed in the skull shown in fig. 2.

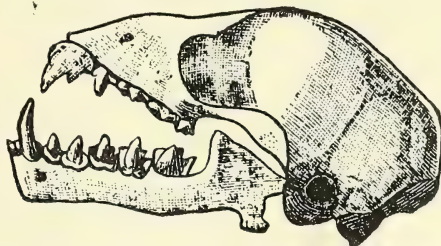


Fig. 2.—Skull and lower jaw (lateral view) of *Megaderma lyra*, the Indian false vampire bat. Note the large canine and the sharp-pointed molar teeth with which it 'crunches' its frog and finny prey.

After Blanford, 1888.

The older writers on the mammals of India—Jerdon (1874), Sterndale (1884), and Blanford (1888)—repeat Frith's statement made to Blyth in 1844, but add nothing as to the piscivorous habits of the big-eared vampire. Thus matters stood for many years—until in 1929—when T. B. Fry published in this *Journal* notes on a collection of mammals made in the Taungoo district in Burma by J. M. D. Mackenzie. Fry quotes Mackenzie that three specimens of *Megaderma* were collected. Of their habits Mackenzie wrote:

I can confirm Mr. Frith's remarks . . . [quoted by Blyth] in every respect. The beasts used to drop frogs' hindquarters, etc., on my mosquito curtain. On one occasion a mouse's head was picked up. Remains of small fish were found, though how bats catch a fish, I am not prepared to guess. Frogs and mice would seem to present sufficient difficulties, even allowing the beast to have the powers of a hawk or owl.

These deposits of 'frog's hindquarters, remains of small fish, etc.' on Mackenzie's mosquito curtain are proof positive of the aquatic activities and piscivorous proclivities of this little false vampire.

From the eye-witness testimony of Blyth and others, it is established that one Indian vampire bat on occasion backslides from its original insectivorous mode of life to prey on small bats, birds, lizards and rodents; and it is probable that all species of the genus *Megaderma* have like habits. Further, from the testimony of Frith in 1844 and Mackenzie in 1929, one cannot doubt that these animals feed on fishes and frogs—water-dwellers. Dissection only is lacking to clinch the point. How they catch these frogs and fishes is a matter for future observers to settle. But, as we shall now see, one observer thought that he had solved the enigma.

THE FLYING FOX—AN ALLEGED FISH-CATCHER.

From Indian insectivorous bats, which do catch and eat fishes, we now turn to an Indian fruit-eater, which in 1863 was alleged to catch fishes. This is the flying fox, *Pteropus*, a much larger bat

than the false vampire considered above. The flying foxes vary in length of body from fourteen to sixteen inches, and in wing-spread from forty-six to fifty-two inches. In great numbers they roost in trees, hanging head downward as shown in the accompanying plate. To give point to the name flying fox, there is reproduced here Sterndale's figure of the long fox-like head (fig. 3).

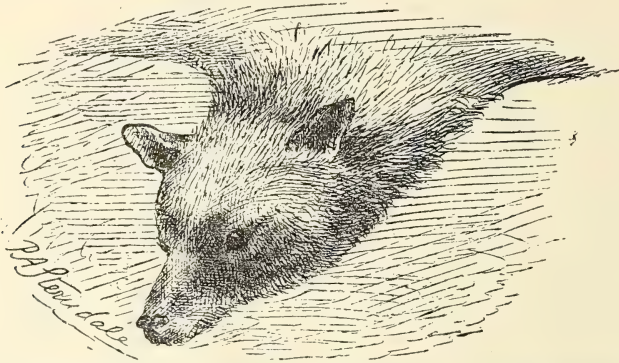


Fig. 3.—Close-up view of the head of a flying fox. This figure clearly shows how well the name fits this bat. Compare it with that of the head of the false vampire (fig. 1).
After Sterndale, 1884.

One glance at it makes unnecessary any comment on the fitness of the name. But it may be noted that there is nothing here to suggest bloodthirstiness or flesh-eating habits such as is to be seen in the little vampire (fig. 1). *Pteropus* is an insectivorous mammal which in long ages has turned fruit-eater.

It is recorded as an 'alleged' fish-eater, and the 'alleger' was one Dr. John Shortt, presumably a medical man, of Chingleput, India. In 1863 he wrote about this frugivorous bat as follows:

'At about 6 p.m. on the 30th of April last [1863], when at Conjeeveram, my attention was attracted to a tank next the Dispensary, which, owing to a light shower of rain which had just fallen, literally seemed alive with small fish gambolling and jumping about in the water. There was nothing new in this; but my attention was drawn to a number of large birds with a somewhat heavy flight, hovering over the water and seizing with their feet the fish, with which they then made off to some tamarind trees on the bund of the tank, to devour them at their leisure, I suppose.

On a closer examination, I discovered that what I had imagined were birds were none other than flying foxes, the *Pteropus edulis*. After watching them fishing for some time, I had to leave, owing to the darkness of the evening. I returned to the tank the next evening half an hour earlier, and again witnessed the same occurrence.

I then got my assistant, Mr. Watson, to bring his gun and shoot some, so that I might satisfy myself as to the identity of these animals. Mr. Watson shot some two or three whilst in the act of seizing their fishy prey, and on examination I found them to be actually flying foxes. During a second visit, on the 5th and 6th of June, I observed the same thing occur again.

I am not aware of the fishing propensities of this animal ever having been noticed, for I find no account of them in any work on natural history that I have ever had opportunities of consulting on the subject. This habit of the flying fox appearing new to me, I send this communication, as there may be others who have witnessed the same thing; and if made known, this would, I am sure, prove of interest to the naturalist.'



FLYING FOXES IN THEIR TREE.

From Brehm's *Tierleben*, Ed. by O. zur Strasser.
Plate opposite Säugetiere I, p. 400. Leipzig, 1912.

Now Shortt was a medical man, presumably trained in dissecting. Having at hand specimens of the bat killed in the very act of the alleged fishing, it is the height of absurdity that he made no dissections, to prove or disprove his conjecture that they catch and eat fishes. Hence, although his letter was published in the Proceedings of the Zoological Society of London in 1863, and republished in 1864 in the Annals and Magazine of Natural History, from the standpoint of showing the flying fox to be a fish-catcher, it is not worth the paper on which it was printed.

The early students of Indian bats all note the habit of *Pteropus* of skimming the water in the evening. Two of them have commented on Shortt's communication. Thus Blanford states that he has often seen *Pteropus* swoop down over ponds, at which time '... the water is just touched, I believe, by the tongue or lower jaw. I have no doubt that some water is drunk'. Last of all Jerdon writes that this fruit-eater swings down to touch the water lightly, and states that 'I could not ascertain if they took a sip or merely dipped part of their bodies in'. Then he adds this brief reference to Shortt: 'A recent writer, on observing this, has jumped to the conclusion that they do this for the purpose of fishing'. (And I may add that 'jumped' is a good word.)

Having seen in *The Field* (London, 1889, April 6) a communication with a reference to Shortt on fishing bats, a person signing himself 'Keswal', at Alibag, British India, sent to the same journal (1889, June 1, p. 767) a note on the subject. In this he tells of seeing *Pteropus* bats skimming over water, disturbing the surface much less than would a swallow one-tenth their size. This was always on fresh, never on salt water. He never saw anything being taken—water, insects or fishes. Nor could he detect any action of the interfemoral membrane or of the claws. The membrane is small and 'Keswal' does not think that it could be used to catch fishes. In brief, 'Keswal's' verdict is that of 'not proven'.

The latest word on this alleged habit is from McCann, who in this *Journal* in 1935 published a careful study of the flying fox, *Pteropus*. He quotes Shortt's letter in full and dissects it skilfully. From a study of many specimens he finds that it is not proved that they eat fishes, but that it is well known that they do eat pulpy fruits, for which their flattened molar or grinding teeth with grooved crowns are well suited; and that the feet are so constructed that they serve only as 'hangers' to suspend the bat from a branch (vide plate). The bats hang heads down and eat fruit without detaching it, or if it is detached, 'hold it in the folded extremities ("wrists") of both wings'. Dissection of more than ten specimens killed early in the morning after feeding all night, revealed stomachs and intestines filled with viscous fluid only—without trace of fish remains. Had Shortt done this, he would never have made his egregious error.

Inspection of the figure of the skull of a flying fox (fig. 4) shows that it has fairly sharp canine teeth, while the grinders (especially in the lower jaw) are broad and blunt. These teeth are adapted for fruit-eating, while those of the false vampire (shown earlier) all

have cusps adapted for piercing the hard exoskeletons of insects or the scales of fishes.

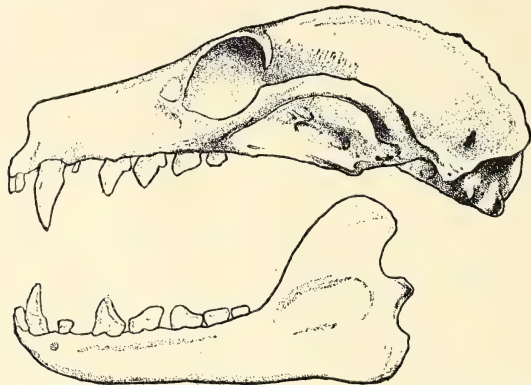


Fig. 4.—Side view of skull and lower jaw of the Indian flying fox, *Pteropus*. The canine teeth are pointed for grasping, but the molars (especially the lower ones) are blunted and flattened for crushing pulpy fruit.

After Blanford, 1888.

The evidence presented as to the feeding habits of the false vampire bats is conclusive as to their preying on vertebrates. They have been seen to capture and eat bats, birds and lizards; and underneath their sleeping places have been found fragments of these animals, of mice and other small rodents, and of frogs and fishes. They have not been seen in the act of catching fishes nor have any fish remains ever been found in their stomachs. However, the presence of such remains under their roosts proves that they eat fishes, and to eat fishes, they must catch them. Perhaps some reader of this article may have the good fortune to see and describe how the fishes are caught.

On the other hand, flying foxes have been seen skimming over the surface of a pond at twilight and the conclusion has been drawn that they were fishing. Though specimens were killed, their stomachs were not dissected. But years later examination revealed that the stomachs of specimens dissected after a night's feeding contained nothing but a 'viscous fluid'. Thus while it is alleged that the flying foxes catch fishes, the allegation is what Mr. Kipling would call 'an Indian solar myth'.

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General view of Mt. Abu from the top of a hill.



Photos by C. McCann

Guru Shikar, 5,650 ft., the highest peak of the Abu Hills (in the background).—Clouds over the valley.

THE RAINS COME TO THE ABU HILLS¹.

BY

CHARLES McCANN, F.L.S.

(With a plate).

The hot weather in the Abu Hills is nearing its close. The grey rocks radiate the heat of a fierce sun. The grass is crushed to dust under foot. Many trees are leafless. Birds sit gaping. Like walking skeletons clad in parchment, cattle roam about in search of grazing. When will the rains break? The koel, as though mocking at the efforts of King Sol, rends the vibrating air with its noisy, monotonous calls. Of course it is happy, it has quite recently hoodwinked the jungle crow and forced upon it its own parental duties. Poor crow! though you have been proverbially gifted with a wise head, you cannot differentiate between your own young and those of the koel! The koel is now getting ready to shirk anew its parental duties.

While the koel was busy cuckolding the jungle crow, another cuckoo, the pied crested cuckoo [*Clamator jacobinus* (Bodd.)] victimised the jungle babbler (*Turdoides terricolor sindianus* Ticehst.) As the month of June wanes on the voice of the koel is seldom heard. It quits the hills for the plains where the common crow (*C. splendens* Vieill.) is now nesting. The common crow with all its shrewdness is saddled with the care of the koel's young. At about the same time as the koel departs from the hills, yet another cuckoo arrives to take its place. This time it is the true cuckoo, from the call of which the family gets its name, namely, the Asiatic cuckoo (*Cuculus canorus telephonus* Heine). Without the clockwork regularity of the cuckoo clock, it punctuates the air with its plaintive mellow notes. In Tod's *Travels in Western India*, p. 99, there are the following references to this cuckoo:—

'While, from an umbrageous peepul, the Kamérie² poured forth his monotonous but pleasing notes, amidst the stillness of a lovely scene, when the last tint of sunset illuminated the dark hues of the surrounding woods.' (June 13, 1822).

again, p. 113:—'The Kamérie³, as usual unseen, uttered its welcome note, and the strong, clear voice of the blackbird⁴ issued from a dark coppice, whence stole a limpid brook, all serving to remind me of the almost forgotten land to which I was about returning.' (June 13, 1822).

The voices of the cuckoo and the blackbird made Tod feel a little

¹ In my previous article on Abu (Vol. xliii, 206) I stated that Guru Sikar is the highest point between the Himalayas and the Nilgiris—my authority for this was the *Gazetteer* (New Ed. 1908). In the light of more recent knowledge this statement must be erased as a peak in Mysore, known as Mulainagiri is 6,317 ft.—nearly 400 ft. higher!

² 'This appellation of the cuckoo is derived from Kama, the God of Love, whose emblems are peculiarly appropriate, being a bow and arrow composed of roses and jessamine, and other flowers in which the Hindu poet allows no thorn to lurk.'

³ *Cuculus t. telephonus*.

⁴ *Turdus merula*.

home-sick; after all both these birds are hardly separable from their European kin, only that they have settled in different lands.

The Asiatic cuckoo is less ambitious than its kinsfolk for, unlike the koel, it lays its eggs in the nests of small birds, such as shrikes, chats, larks, pipits and wagtails—foster parents all much smaller than the foster children, and what a job these little 'parents' have to keep the enormous cavity filled!—a cavity sometimes large enough to engulf the feeder! Again, unlike the koel, this cuckoo does not restrict its activities to the hills, but is common in the plains as well. Its hosts breed above and below. Its flight is very hawk-like and as soon as it takes to wing there is broadcast a general warning as though some bird of prey threatened. It will often sit in the same tree for a considerable time and pipe its song; with tail fanned out and wings dropped; the head is moved backwards and forwards with each note, and the whole body moved round in a semicircle. The whole behaviour is much like that of a courting pigeon.

Many a flower has passed into fruit. The curanda (*Carissa Carandas* L.) remains in fruit much later than it does on the Western Ghats—it is still in fruit at the end of July, whereas on the ghats fruiting is usually over by the end of May or middle of June. The red-vented bulbul [*Molpastes cafer* (L.)] takes full advantage of this source of food supply and continues to breed. I found nests with eggs, newly hatched young, and fledged young at the end of July! Having remarked on the late fruiting of the curanda it is worth noting that many of the deciduous trees which were in full foliage a month or more ago in the Ghats were yet leafless, or only just putting out new leaves! Accordingly, the flame of the forest (*Butea frondosa* Koenig), which flowers round about Bombay in January and February does not bloom till March or April about Abu. Going by train yet further north the same tree is found to flower later still. A typical example of the differences brought about by climatic change.

Silently the mists creep over the hills, and shed a portion of their moisture, only to be evaporated as it touches mother earth—she is thirsty. The rains at last! The first showers are a signal for great activity, both above and below ground—a new life sets in. Dormant Nature rises once more to a brief spell of intense activity and later will go to rest again—the ebb and flow of life. It is July, the violence of the winds increases and brings along the mists, and soon the hills are shrouded in vapour—Abu is in the clouds! The air is cool and the cuckoo is more often heard, but the koel is silent—it has gone. Water rushes over the earth, but soon disappears down the numerous water-courses. The hot rocks return part of it as steam. Birds flit gleefully about in the first showers—they sing their thanksgiving to the great 'Rain God', and pipe to Venus for success in the marriage market—it is breeding time for many of them. My 'sentries' on the hills were to keep me informed of the weather conditions—I was out to catch the early monsoon plants. According to plan, to use a well-worn phrase, I found myself on another 'Busman's Holiday' back again in Abu on the 3rd July. It was quite a different picture from the one I had seen some months back. Where pulverized plant dust covered the ground,

now appeared the new grass, and the scorched rock faces were matted with green and other hues—yes, altogether different to the drab grey and khaki of the dry weather.

The appearance of the beautiful sprays of pink flowers of an epiphytic orchid (*Aerides*) heralded the change. Some sprays were still to be seen on my arrival; they were to be found almost everywhere, on trees, bushes, and even on rocks, most of them facing southwest, the side from which the monsoon was to come, and the direction the wind blew at the time of the seed dispersal. Tod (l.c. p. 114) makes a passing reference to this orchid. Abu is poor in orchids. Besides the *Aerides*, a little rain sends up a handsome yellow ground orchid, *Eulophia ochreatea* Lindl. At first it raises its yellow plume to the heavens, but this is soon followed by the broad leaves folded fanwise in bud. About the middle of the month (July) appear the leaves of three terrestrial orchids, all *Habenarias*, much less attractive than the two mentioned above, and just interesting enough for botanists to quarrel over! Strangely enough members of the *Liliaceae* and *Amaryllidaceae* are very scarce in these hills.

In the cracks and crevices of the rocks appear curiously folded leaves, sometimes in clusters, at others in long lines, according to the situation. They soon unfold to betray their true identity—a member of the Arum lily family with a ‘forbidding’ name, *Sauromatum guttatum* Schott. The corms were lying hidden below ground. The plant generally flowers in the cold season, about February, and the leaves appear during the rains. The flower is no beauty—the spathe is a long strap-like affair coloured like decomposing flesh and with an odour to match—the right sort to attract carrion insects (flies) which carry the pollen from one flower to another, and thus aid in fertilization. Flowers are produced only by corms of a certain size, and the size and shape of the leaves vary in accordance with the age or size of the plant. Most of the members of this Order of plants, *Araceae*, have the tissues filled with needle-like crystals—a reason why many of them cannot be used as food. The crystals set up a fearful irritation in the mouth and other membranes, and if too numerous give rise to alarming conditions. However, for the first time I discovered that *Sauromatum* was eaten. Some of the locals collect the leaf stalks and prepare them as a vegetable. Boiling often destroys the crystals.

The irritation caused by the crystals reminds me of an incident which took place when one of the school ‘bearers’ saw my son collecting some corms for me. Suspecting that the lad was collecting them to eat, the bearer warned him against them. Impishly, my son replied that he had already eaten two! The man disbelieving him at first asked him to put out his tongue—there was nothing wrong with it. Accordingly he put aside his caution and chewed a couple of bits! All I need say, being a school servant he should have known boys better; he hastened to the cook for some butter to ease his suffering. This incident takes me back to my own school days. Stories are still current among the Jesuit Fathers of the trouble I caused them by eating wild plants and fruits. Other boys tried to imitate me, but very often ate the wrong

thing much to the discomfort of themselves and the infirmarian! Being a lad who had passed my childhood in the districts and with the local people I knew many of the plants that could be eaten. Catching snakes was another grievous fault of mine in those days, and still is. It was the cause of much anxiety to my parents and the good Fathers. Well, I am still alive!—the Devil looks after his own.

Two other members of the *Araceae* occur, (a) *Remusatia vivipara* Schott—a partially epiphytic species, and (b) *Colocasia antiquorum* Schott—a wild form of the edible plant. Along with *Sauromatum*, or apart grows a member of the *Canna* family—a *Curcuma*—with a pinkish 'brush' of bracts which partially hide the yellowish flowers. The layman usually mistakes the entire inflorescence for either a flower or a series of flowers and consequently overlooks the flowers themselves. The canna-like leaves appear shortly after the spike and betray the true relationship. The flowers soon fade, but the spike persists for quite a time.

Shortly after the first showers many are the botanical curiosities that appear, and if the botanist wishing to study them is not on the spot at the right time, he just 'missed the bus' and will have to wait for the next season. The curiosities are too many to be recorded individually, but I cannot pass on without mentioning a couple. A curious little fern, which grows in suitable rocky places is the Snake's Tongue fern (*Ophioglossum*). Two species occur. From the layman's point of view these ferns are insignificant looking little plants, in fact, he would scarcely recognise them to be ferns, but to the botanist they are wonders! Several other ferns now begin to uncoil themselves—the leaves protruding in corners like groups of question marks. Here and there I saw some twining plants which looked suspiciously like the beginnings of a genus of the *Asclepiadaceae*, *Ceropegia*, a genus I am particularly interested in. My suspicions were soon confirmed as I eventually found it in flower—it was a *Ceropegia* and one I had not seen before. In the Western Ghats near Bombay, *Ceropegias* are not common; mainly, I think, for the reason that the locals always dig them up for the sake of the tubers which are eaten either raw or cooked. Though the 'Abuites' know the food value of the tubers they do not seem to worry about them to the same extent as the people do in the ghats.

A host of insects and other animals respond to the rain. The once silent nocturnal air, only disturbed by the occasional 'dung roller', was now full of the whirl of insects' wings. The 'grand opera' of the amphibians rends the still air. The frogs and toads, with their croaks and pipings rejoiced vociferously—it was breeding time. Just as a musician can pick out the tones of one instrument from many, so also the trained ear of the naturalist can identify the voices of the various species in the amphibian concert. There were toads, *Bufo melanostictus* and *B. andersoni*; the burrowing frog, (*Rana breviceps* Schneider) and the skipper (*R. cyanophlictis* Schneider); these four were the main voices. Now and again the bass of a bull-frog (*R. tigrina* Daud.) punctuated the chorus. This hilarity commenced at dusk and stopped at dawn—daylight drove

the revellers to hiding. After a couple of weeks the amphibians turned their attention to feeding—there were plenty of insects about. In my previous paper on Abu I did not record *B. andersoni* Bouleng. and *R. breviceps* as occurring on these hills, but now I found them to be plentiful and breeding. These two bring the total of Abu frogs to seven. Of these, all with the exception of *B. andersoni* occur in the Western Ghats. *Microhyla ornata* Boulenger and *R. breviceps* I have not found on the plain.

If insects spell food to frogs, frogs mean food to snakes. Accordingly the snakes made their appearance in fair numbers. Abu has its quota of the 'big four', the cobra, the Russell's viper, the common krait and the saw-scaled viper. The last two I did not record in my previous paper, namely, *Bungarus caeruleus* Daud. and *Echis carinata* Merr. *Echis* is usually a terrestrial beast, but at Abu I discovered it took to climbing during the rains, evidently in order to get out of the wet. The first time I ever saw an *Echis* up a tree was in Cutch and I accordingly remarked on it in my paper on the Reptiles of Cutch. In Cutch it had evidently climbed up to get out of the long grass into the morning sun, as animals usually do. Fr. Hippolytus, having read my article on the Reptiles of Cutch, wrote to me as follows:—

'I would like to say that the *Echis carinata* is very often found in trees—chiefly during the monsoon—. When in the jungle near Dohad and going on horseback to the villages I have seen it often basking on the broad leaf of *Butea frondosa*—at the height of a man on horseback. I have knowledge of 2 of my people being bitten by them on trees—one was bitten in the 1st finger of his left hand and he chopped it off at once with his axe. The other was bitten in the back as he was coming down from a tree. The Bhils know it well and call it "galtar kot", for them the viperids are not "samp" (snake) they are "kots". They call this "galtar" because it causes the bitten part to rot—"galwun".'

The behaviour of *Echis* in Abu during the rains certainly confirmed this point. A specimen killed while in a bush contained the remains of a burrowing frog.

Among the harmless species of snakes not mentioned in my previous paper, there are (1) common cat snake (*Dipsas trigonata* Boie) a dark form much resembling *Echis* in colour and habit. It may easily be mistaken for the latter; (2) Forstein's cat snake (*Dipsas forstenii* Günth.), a specimen was killed by the boys in St. Mary's High School; (3) the trinket snake (*Coluber helena* Daud.) is quite common; (4) the common wolf snake (*Lycodon aulicus* Boie) is also met with; (5) the python (*Python molurus*) is frequently killed by the Bhils; (6) the small blind snake¹ (*Typhlops*, probably *brahminus*) a specimen was discovered under a stone by my son Trevor but unfortunately it escaped later. This is the first *Typhlops* I have seen in these hills. This brings the total number of the species of snakes met with in Abu to eleven. The discovery of Forstein's cat snake, I believe, constitutes an extension of its range.

¹ Since writing, my son sent me two specimens of *T. brahminus*,

The common monitor (*Varanus monitor* Smith) appeared to be more frequent than at other times. The day I arrived my son, Carl, came to greet me with a three-footer over his shoulder as though it were a tame squirrel—he took it about with him like a dog on a leash! I could never understand why the animal never made an attempt to bite him—he handled it most carelessly. A few days later he caught another, somewhat bigger than his ‘pet’ but very much less docile. ‘Suffering Cats! another naturalist in the house’ said Ma. ‘Hav’nt I enough with one?’. The monitor is responsible for the destruction of many ground-breeding birds, however it also keeps in check a lot of vermin. Between the monitor and the mongoose the feathered game must suffer a good bit. The blood-sucker (*Calotes versicolor* Daud.) was breeding. One female contained eggs about to be laid—a few days after capture she voided 16 eggs. The geckoes (*Hemidactylus brookei* Gray) and (*H. flaviviridis* Rüppell) were common. A small skink¹ [*Ablepharus grayanus* (Stoliczka)] was not uncommon among the dead leaves in the forests. The little animals, barely more than three inches long, were difficult to catch as they glided in and out of the fallen leaves. This discovery constitutes a new record in the distribution of this lizard, as the localities quoted in the *Fauna* (2nd Ed. Vol. II, p. 312) are:—Sind, Karachi; Waggur district, Cutch; Las Bela State, Quetta district, Baluchistan. At the time when I collected this creature I had my hands full of plants and no receptacle to put it into, so I put it under my hat. I had accidentally killed it with my stick. A few yards further on I took off my hat, forgetting I had the lizard under it. It was only after I had gone some distance away that I remembered it. I searched the hat, but there was no lizard. Back I went to the spot where I had removed my hat and spent a good fifteen to twenty minutes searching for the animal without success, and gave it up as lost. On my return home I re-searched my hat and turned out the lining but could find nothing. Some time later when I sat down to write up my notes I ran my fingers through my hair. There was something there, which when I removed it, turned out to be the missing lizard! Thus a new record might have been lost, for it was only on my return to Bombay that I was able to establish the identity of this ‘rarity’.

The common myna [*Acridotheres tristis* (Linn.)] nested in the date palms and convenient holes in masonry. The brahmī myna [*Temenuchus pagodarum* (Gmelin)] which I have not noted at other seasons paraded a family on every grass slope in search of food. The jungle babbler (*Turdoides*) followed its example. By the middle of July the pied crested cuckoo had departed. The Indian robin [*Saxicoloides fulicata* (Linn.)] and the pied wagtail [*Motacilla l. maderaspatanensis* (Gmelin)] were also engaged on domestic duties. Among the leaf bases of the date palm the rufous-backed shrike (*Lanius schach* Linn.) reared its family. The black-capped black bird (*Turdus simillimus*) was in full song almost

¹ Since writing, my son sent me two specimens of another small skink, *Riope punctata* (Gmelin) Smith—a welcome addition to the list of Abu lizards.

everywhere and was evidently breeding. It is only during the breeding season that this bird is in full song. It sits high up in a tree and pours forth its delightful liquid notes; at other times of the year I have only heard the familiar *chuck-chuck-chuck*—a warning note. I have not noticed this bird on the hill at other seasons. The red-rumped swallow (*Hirundo durica* Linn.) collected mud for a future home. The crested bunting [*Metophus melanicterus* (Gmelin)] moved about in couples and were apparently breeding. Ioras and white-eyes also seemed to have their family cares. The white-breasted kingfisher [*Halcyon smyrnensis* (Linn.)] breeds in the hills. My son found a nest with four fledged young. From the remains outside the nest, crabs seem to have figured largely in their diet. The pied kingfisher (*Ceryle rudis* Linn.) which is seen during the dry season was not found at all. The fantail flycatcher, the yellow-cheeked tit [*Machlolophus xanthogenys* (Vigors)] and Tickell's blue flycatcher [*Muscicapa tickelliae* (Blyth)] to judge from their behaviour were also worried with domestic cares. The brown rock-chat [*Cercomela fusca* (Blyth)] was very common and true to its name tenanted almost every stretch of rock. It was in full song and apparently breeding. Parrots though common enough during the dry season were less frequent, but in the plains they were seen in somewhat large flights on the *nim* trees. This is just a brief list of some of the birds noted.

The filling of the streams was welcomed by the fish fraternity. The streams rise and fall very rapidly according to the extent of the downpour. The small fish that inhabit them take advantage of each rise and try to get upstream; *Danio aequipinnatus* (McClelland) is one of them and is abundant. They can be clearly seen trying to clear the 'rapids', some try to jump clear and are often stranded in the effort, others try to run up in the shallow water flowing over the rocks. The locals know their habits and wait for them at suitable points and handpick them and hurl them ashore to jump to death and be gathered up later. Among the rocks is also another fisherman, the checkered water snake (*Tropidonotus piscator*). It is often seen trailing about with a 'silver tongue' protruding from its mouth—a catch.

At this season butterflies are singularly scarce. The only species I saw were *Ixias pyrene* (Linn.), *Huphina n. evegate* Cr., *Belenois mesentina* Cr., *Terias* sp. and a grass blue Lycaenid; and these too were few and far between.

Between spells of fever in bed and rambles in the forest my holiday soon passed, only to regretfully discover that I could not do all I had intended to do, in spite of a short extension of leave, due to my ill health. Nevertheless, I made several interesting discoveries and was able to amplify my notes very considerably. A naturalist, if he really wants to study nature at all times, must forget he has a sensitive skin—I forgot mine, and had to pay for it—*mea culpa*! I am always told so, but how often do we harken to 'words of wisdom'? Babies sometimes utter them!

On the 25th my wife and I bid farewell to our children and to our kind friends. Our thanks go to our friends whose kindness made this short trip possible. *Au revoir*, Abu!

FISH SURVEY OF HYDERABAD STATE¹.

*Part I-A Preliminary Report on Fishes found in the Godavari,
Purna, Kistna, Tungabhadra and Siddha Rivers.*

BY

M. RAHIMULLAH, M.SC., F.Z.S.

*Department of Fisheries, H. E. H. the Nizam's Government,
Hyderabad—Deccan.*

INTRODUCTION.

So far very little work has been done on the fauna of the Hyderabad State. However, some papers on fishes from this region have been published from the Zoology Department of the Osmania University by Das and the author. Mention has also been made of certain fishes from the Deccan Plateau by Spence and Prater, and lately by Fraser. In the present series of articles I propose to give a systematic account of the fish fauna, and in this first instalment fishes obtained during our survey of some of the principal rivers are listed. The survey was conducted in different seasons of the year so as to collect, as far as possible different varieties of fish and to form an idea of their seasonal occurrence.

The Hyderabad State (H.E.H. the Nizam's Dominions) is the largest amongst the Indian State and lies between $15^{\circ}10'$ and $20^{\circ}40'N$. $74^{\circ}40'$ and $81^{\circ}35'E$. with an area of 82,698 sq. miles. It is situated almost in the centre of the Deccan Plateau, touching Khandesh District (Bombay Presidency) on the north-west, Berar and Central Provinces are on the north; rivers Kistna and Tungabhadra separate it from Guntur, Kurnool and Bellary districts of the Madras Presidency. On the west are Ahmednagar, Sholapur and Dharwar of Bombay Presidency, and on the east it is separated from Wardha district by the Painganga river, and from the Madras Presidency by the river Godavari. The total population, according to the census of 1931, is 14,436,148, the average absolute density being 175 per sq. mile.

The average elevation of this extensive plateau is about 1,250 ft. above sea level, with a few summits here and there arising from 2,500 to 3,500 feet. It is roughly divided into two large divisions, geologically and ethnologically quite distinct, separated from each other by the rivers Manjra and Godavari. The portion to the north and west belongs to the trappean region (that is to say, the Marathwari and the Kanarese regions); that to the south and east being granitic and calcareous, and is known as the Telangana side. The

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former or the black cotton soil country grows wheat and cotton, while the latter is mainly rice producer and full of small and large tanks.

The black cotton soil is richer and retains water longer, and is, therefore, covered with luxuriant vegetation with cliffs, crags and undulating hills. In the granitic region of the Telangana districts, the hills are almost bare of vegetation, only low shrubs being found; but low down in the more even places trees and jungles are present, the most famous of which are in Adilabad and Warangal districts. The soil in this region is sandy and in parts consists of gravel, and hence does not retain water. This necessitates the storing up of water in big and small reservoirs and tanks. The surface of the country has a general slope from north-west to south-east, the main drainage being in this direction.

The principal mountain range is Balaghat, extending almost from the east to the west of the Hyderabad State, with a length of 200 miles and an average width of 4 miles from east of Nander district to Ashti in Bhir district. The Shyadriparvat runs along the north, from Nirmal in the east, reaches Ajanta after passing Parbhani and the Province of Berar, and proceeding further in a westerly direction, it finally reaches Khandesh district (Bombay Presidency). The total length of the mountain within the State is about 250 miles and some 100 of this form the Ajanta hills containing the famous Ajanta frescoes. Besides, the Jalna hills, Kindikalgutta (or Sirnapalli) and others are smaller ranges passing through the State.

The oldest lake is 'Pakhal Lake' situated in the Narsampet Taluk of the Warangal district surrounded by dense jungle. Other big reservoirs and perennial tanks are Nizamsagar, Alisagar, Singtom reservoir, Ellareddi tank, Manchappa tank and Masani tank (Nizamabad district), Osmansagar Himayatsagar, Mir Alam tank and Hussainsagar (Hyderabad and suburbs), Pocharam (Medak district). Dindi and Pindipakla reservoirs (Nalgonda district), Lakhnawaram lake, Ramappa lake, Wyra and Palair reservoirs (Warangal district). Smaller tanks are thousands in number and will be dealt with in the reports on the fish-survey of different districts.

The principal rivers are the Godavari and the Kistna with their tributaries, the Purna, Manjra, Penganga, Tungabhadra, Bhima, Maner and some other smaller ones, such as Musi, Eesi, Windi, Munair, etc. The river Godavari enters the State at Phultamba in Aurangabad district, flows through it and the districts of Parbhani, Nander and Adilabad for a distance of 500 miles, and changing its course at the north-east corner of Elgandal, continues in a south-easterly direction for about 170 miles, forming the eastern boundary of Karimnagar and Warangal districts until at Paranthpali it enters the Godavari district of Madras. Near Bhadrachellum it has a precipitous fall of more than 100 ft.; there being no anicut or dam across this river in our State, but there exists an anicut at Dummugudum in the East Godavari district; the absence of reservoirs is due to the fact that this river flows mostly through the black cotton soil area where water is not much needed. It is joined by the Manjra which rises in the Patoda taluka of Bhir district after a course of 387 miles through Bhir, Osmanabad,

Bidar, Medak, and Nander districts; there being one anicut across it at Ghanpoor (Medak district) and a dam forming the Nizamsagar reservoir (Nizamabad district). The bed of the river Godavari varies according to the tract of land through which it flows. In the upper reaches it is stony, and boulders are found here and there; but as it flows down, the soil becomes sandy and muddy in places (near Nander), and still further down it flows through hilly tracts and cuts through rocks near Adilabad and falls down about a 100 ft. through a gorge near Bhadrachellum.

The Kistna crosses the border of the Bijapur district of the Bombay Presidency at Echampet near Lingsugur, and taking a south-easterly course traverses the districts of Raichur, Mahboobnagar, Nalgonda and Warangal, forming the southern boundary of the last three districts and, consequently of the State. The Penganga rises in Shyadriparvat range and runs east along the north of Hyderabad separating Parbhani, Nander and Sirpur Tandur (now Adilabad) districts from the southern part of Berar. It joins Wardha river north of Rajura Taluka. The beds of these two rivers are mostly rocky and full of boulders of stone.

As all these rivers flow through a table-land the beds are very deep and at some places more than 100 ft. below the general level of the fields. The volume of water during the rainy season is tremendous, but during the hot and dry season smaller streams dry up completely and in larger ones some deep pools are formed and a small slow-moving stream of water joins them; some pools in the river Kistna are reported to be more than 150 ft. deep.

The average annual rainfall varies from 28 in. to 33 in.; the average temperature varies from 72.7°F. to 92.3°F. during the year, but in certain districts such as Warangal, Nalgonda, etc., it sometimes goes up as high as 114°F.

The survey work was started by the Fisheries Department with a view to find out various kinds of food-fishes in the Hyderabad State. It is proposed to carry out the survey of different districts in which there is a possibility of improving the fishes by establishing fish-farms and stocking ponds and tanks; the introduction of exotic fishes, such as 'gourami' and 'pearl spot' (*Etrophus*), from other Provinces is also under contemplation. Investigations are also being carried on the larvicidal fishes in co-operation with the Public Health and Sanitation Department. There is a great possibility of developing the freshwater fishery of the Hyderabad State, because here we have: (a) large rivers, such as Godavari and Kistna with their important tributaries such as Manjra, Bhima, Painganga; (b) very large artificial and natural lakes, such as Nizamsagar, Pocharam, Dindi reservoir, Pakhal lake; and (c) more than 30,000 tanks and long stretches of irrigation canals.

LISTS OF FISHES.

1. River Purna near Purna town. 13-8-1941.

Bottom sandy in the middle and black clay near the banks. Dries up during summer. Young specimens of *Mystus aor*, locally

known as 'sengal', were obtained in August, and from their size it is presumed that they have hatched in the beginning of the rainy season.

Barbus (Puntius) kolus Sykes.
Barbus (Tor) khudree Sykes.
Chela bacaila Ham.
Chela clupeoides (Bloch).
Aspidoparia morar (Ham.).
Glossogobius giuris (Ham.).
Ophicephalus marulius Ham.
Notopterus notopterus (Pallas).

Rohtee belangeri (Cuv. & Val.).
Rohtee cotio var. *cunma* Day.
Mystus aor (Ham.).
Mystus armatus (Day).
Rita hastata Val.
Callichrous bimaculatus Bloch.
Proeutropichthys taakree (Sykes).
Bagarius bagarius (Ham.).

II. (a) River Godavari near Nander and Basar. 15-8-1941.

Bottom generally sandy, but gravelly in parts.

Barbus (Puntius) dorsalis (Jerdon).
Barbus (Puntius) kolus Sykes.
Barbus (Puntius) sophore Ham.
Barbus (Puntius) ticto Ham.
Barbus (Tor) khudree Sykes.
Rohtee cotio var. *cunma* Day.
Mastacembelus armatus (Lacép.).
Notopterus notopterus (Pallas).
Mystus aor (Ham.).
Mystus vittatus (Bloch).
Rita hastata Val.

Barilius bendelisis Hamilton.
Chela clupeoides (Bloch).
Ophicephalus marulius Ham.
Rasbora daniconius (Ham.).
Ambassis nama (Ham.).
Rita pavimenta Val.
Callichrous bimaculatus (Bloch).
Clarias batrachus Linné.
Proeutropichthys taakree (Sykes).
Silonopangasius childrenii (Sykes).

(b) River Godavari at Nander. 8-1-1942.

Barbus (Puntius) dorsalis (Jerdon).
Barbus (Puntius) kolus Sykes.
Barbus ticto Ham.
Barbus (Tor) khudree (Sykes).
Glossogobius giuris (Ham.).
Chela clupeoides (Bloch).
Silonopangasius childrenii (Sykes).

Chela phulo Ham.
Aspidoparia morar (Ham.).
Labeo fimbriatus (Bloch).
Cirrhitina reba (Ham.).
Barilius barila Ham.
Mystus aor (Ham.).

(c) River Godavari near Nander and Basar. 8-5-1941.

Fishes collected from deep pools and from amongst the boulders (summer season).

Barbus (Puntius) kolus Sykes.
Barbus (Puntius) sophore Ham.
Barbus (Tor) khudree Sykes.
Barilius barna (Ham.).
Cirrhitina reba (Ham.).
Chela clupeoides (Bloch).

Ambassis nama (Ham.).
Glossogobius giuris (Ham.).
Rohtee belangeri (Cuv. & Val.).
Mastacembelus armatus (Lacép.).
Mystus aor (Ham.).
Rita hastata Val.

III. Kandahar tank (Nander District). 17-8-1941.

Small tank with muddy bottom. Not fed by any river. Not perennial.

Barbus (Puntius) sophore Ham.
Barbus (Puntius) ticto Ham.
Labeo boggut (Sykes).
Danio aequipinnatus (McClelland).
Garra stenorhynchus (Jerdon).
Rasbora daniconius (Ham.).

Esomus danricus (Ham.).
Glossogobius giuris (Ham.).
Ophicephalus punctatus Bloch.
Lepidocephalus guntea (Ham.).
Rohtee cotio var. *cunma* Day.

IV. (a) *Kistna river near Gadwal.* 21-9-1941.

Bottom rocky and full of boulders. Flow of water very rapid. (Rainy season).

<i>Barbus (Puntius) kolus</i> Sykes.	<i>Ophicephalus punctatus</i> Bl.
<i>Barbus (Puntius) sophore</i> Ham.	<i>Rohtee vigorsii</i> Sykes.
<i>Barbus (Tor) neilli</i> Day.	<i>Lepidocephalus guntea</i> (Ham.)
<i>Labeo boggut</i> (Sykes).	<i>Nemachilus botius</i> (Ham.).
<i>Labeo fimbriatus</i> (Bloch).	<i>Ambassis nama</i> (Ham.).
<i>Labeo calbasu</i> (Ham.).	<i>Glossogobius giuris</i> Ham.
<i>Labeo porcellus</i> (Heckal).	<i>Mystus bleekeri</i> (Day).
<i>Rasbora daniconius</i> (Ham.).	<i>Rita hastata</i> (Val.).
<i>Chela clupeoides</i> (Bloch).	<i>Bagarius bagarius</i> (Ham.).

(b) *Kistna river at its confluence with river Bhima.* 6-2-1942.

Rocky bed and full of boulders. Fishes collected from deep pools of water (winter season).

<i>Barbus (Puntius) kolus</i> Sykes.	<i>Barbus (Puntius) ticto</i> Ham.
<i>Barbus (Puntius) sophore</i> Ham.	<i>Labeo calbasu</i> (Ham.).
<i>Labeo fimbriatus</i> (Bloch).	<i>Glossogobius giuris</i> (Ham.)
<i>Labeo porcellus</i> (Heckel).	<i>Mastacembelus armatus</i> (Lacép.).
<i>Labeo boggut</i> (Sykes).	<i>Nemachilus denisonii</i> (Day).
<i>Chela clupeoides</i> (Bloch).	<i>Rohtee vigorsii</i> Sykes.
<i>Chela phulo</i> Ham.	<i>Garra stenorhynchus</i> (Jerdon).
<i>Barilius barna</i> Ham.	<i>Gagata viridescens</i> (Ham.).
<i>Barilius bendelisis</i> Ham.	<i>Mystus bleekeri</i> (Day).
<i>Aspidoparia morar</i> (Ham.).	<i>Rita hastata</i> (Val.).
<i>Danio aequipinnatus</i> (McClelland).	<i>Proeutropichthys taakree</i> (Sykes).

V. *Sengal tank, Gadwal.* 23-9-1941.

Bottom—black mud. Profuse vegetation in the shallower parts.

<i>Barbus (Puntius) sophore</i> Ham.	<i>Rasbora daniconius</i> (Ham.)
<i>Chela clupeoides</i> (Bloch).	<i>Lepidocephalus guntea</i> (Ham.)
<i>Glossogobius giuris</i> (Ham.).	
<i>Ophicephalus punctatus</i> Bl.	

VI. (a) *Tungabhadra river near Alampur and Sunkesula anicut.* 24-9-1941.

Bottom consists mainly of black mud near the banks and sand in the deeper parts; boulders and rocks are very few and scattered (rainy season).

Fingerlings of *Bagarius bagarius* were found in large numbers down the Sunkesula anicut trying to go up the current.

<i>Barbus (Puntius) kolus</i> Sykes.	<i>Glossogobius giuris</i> (Ham.).
<i>Barbus (Puntius) parrah</i> Day.	<i>Laubuca laubuca</i> (Ham.).
<i>Barbus (Puntius) sophore</i> Ham.	<i>Mastacembelus pancalus</i> (Ham.).
<i>Barbus (Puntius) ticto</i> Ham.	<i>Rohtee neilli</i> Day.
<i>Labeo fimbriatus</i> (Bloch).	<i>Rohtee vigorsii</i> Sykes.
<i>Chela clupeoides</i> (Bloch).	<i>Mystus aor</i> (Ham.).
<i>Rasbora daniconius</i> (Ham.).	<i>Mystus Tengara</i> (Ham.).
<i>Aspidoparia morar</i> (Ham.).	<i>Silonopangasius childrenii</i> (Sykes).
<i>Danio aequipinnatus</i> (McClelland).	<i>Bagarius bagarius</i> (Ham.).

(b) *Tungabhadra river six miles down Alampur.* 12-1-1942. (Winter season).

Bottom gravelly and consists of boulders and rocks. Fishes collected from deep and shallow pools. About 2 dozen fingerlings

of 3 in.-4 in. of *Catla*, which is indigenous (some fingerlings of *catla* were caught from the Manjira river also) were obtained from some shallower regions of the river. I think this fish breeds much later in the Kistna than in the Godavari but more data will be collected on this point in due course.

<i>Barbus (Puntius) kolus</i> Sykes.	<i>Danio aequipinnatus</i> (McClelland).
<i>Barbus (Puntius) sophore</i> Ham.	<i>Glossogobius giuris</i> (Ham.).
<i>Barbus (Puntius) ticto</i> Ham.	<i>Rohtee cotio</i> var. <i>cunma</i> Day.
<i>Barbus (Tor) khudree</i> Sykes.	<i>Mystus aor</i> (Ham.).
<i>Catla catla</i> Ham.	<i>Mystus bleekeri</i> (Day).
<i>Chela clupeoides</i> (Bloch).	<i>Gagata viridescens</i> (Ham.).
<i>Cirrhitina reba</i> (Ham.).	<i>Rita hastata</i> (Val.).

VII. Siddha river near Bhainsa (Nander District). 10-5-1942.

A small river, usually dry during summer excepting some shallow pools—.

<i>Barbus (Puntius) sophore</i> Ham.	<i>Mastacembelus armatus</i> (Lacép.).
<i>Chela clupeoides</i> (Bloch).	<i>Rohtee cotio</i> var. <i>cunma</i> Day.
<i>Rasbora daniconius</i> (Ham.).	<i>Mystus tengra</i> (Ham.).
<i>Glossogobius giuris</i> (Ham.).	

ACKNOWLEDGEMENTS.

I am indebted to the Revenue and Public Works (Irrigation) departments for all the facilities and help extended to me during the survey work. My thanks are due to Dr. S. L. Hora for helpful suggestions and identification of some doubtful specimens. I am also indebted to the Pro-Vice-Chancellor, Osmania University, Professors B. K. Das and M. Sayeeduddin for allowing me to consult their departmental libraries and also to the Additional Revenue Secretary (Rural Reconstruction) for encouragement and facilities during this work. I am much indebted to the Assistants of the Department of Fisheries for help in the identification of fishes, etc.

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REVIEW

THE BUTTERFLY FAUNA OF CEYLON. Woodhouse and Henry. Printed at Ceylon Government Press, Colombo. 12×10, xiv+153 pages; 37 coloured and 13 uncoloured plates; map of Ceylon. Price 20 rupees or 30 shillings.

I suppose that something like ninety percent of amateur entomologists in India and Ceylon are interested chiefly in the collection of butterflies. This book will be desired by all enthusiasts in Ceylon and by most in India. The book is beautifully bound, the general production is of high quality; the plates are 'entirely a "Home-made" (Ceylonese) production' using a new method, and the authors are to be congratulated, not without a touch of envy, on having been able to get their work produced in such excellent form by a government press, especially under present conditions.

There is a good glossary; the 34 introductory pages cover such subjects as a general account of the life-history and of the structure of the different stages, classification, habits, mimicry, variation, collection, preservation and a detailed account of an original 'wax-and-gum' method of fixing wing patterns, the last having been used for producing most of the coloured plates. There are indexes of scientific and popular names, a bibliography and a list of food plants with Singhalese and Tamil equivalents. The 37 coloured plates illustrate adults, showing upper and lower sides of the wings and are mostly quite good, any defects being pointed out in the text; the remaining plates are uncoloured and with the exception of one of aberrations and one of eggs, are illustrations of caterpillars from Moore's 'Lepidoptera of Ceylon'. The body of the text consists of notes on all the Ceylonese species; these are not really 'detailed descriptions' and it is implied that identifications should be made by comparison with the illustrations; detailed diagnoses of families and genera are not given but these can be obtained by those who need them from other sources, such as Evan's 'The Identification of Indian Butterflies'; what is known of the habits, larva and pupa of each species is stated.

The pleasures of reviewing a book seem to be first, the retention of the review copy (missed in my case, since it has to be returned to the Bombay Natural History Society) and second, fault finding. Actually I have little to say and the following suggestions are meant in a helpful spirit. On opening the book we find, on the page explaining the frontispiece, three words: pseudaposematic, aposematic and procryptic which are not defined in the glossary; in the latter 'terminal' should surely be 'terminal'; I note that 'Kremaster' means 'suspender'; as usual the Greeks have a word for it. There is good evidence for separating the Hesperidae as a separate superfamily (Hesperioidea) from the remaining butterflies (Papilionoidea) but this is only hinted at on p. 12; incidentally larvae of Hesperidae differ from other butterflies and the higher moths in having the crochets on the prolegs arranged in a circle, a character associated with concealed feeding. In referring to segments of the larva it is preferable to consider the head, thoracic and abdominal segments separately rather than to take head and thorax together as segments 1-4 (page 5); when describing larvae myself I have used simple abbreviations (T₁ to T₃ and A₁ to A₁₀) to avoid tedious repetition of the words 'thoracic' and 'abdominal' when referring to particular segments.

Preservation and storage of butterflies are described in detail, together with an account of the ingenious wax-cum-gum method for wings, but the preservation of eggs, larvae and pupae is not. I consider it regrettable that so many amateurs should concentrate their activities on building up as complete as possible a collection of butterflies (compare stamp-collecting) when there are other aspects that are so neglected and so important. For example, why not build up an authentically identified collection of immature stages? Practically nothing is known of Oriental caterpillars for example and they will have to be dealt with some time; it is true that classification of larvae is not particularly easy and is in fact a specialist's task, since minute morphological details must be considered and descriptions must be comparative; the old-fashioned description of colours alone is not enough (I speak with feeling as an 'economic' entomologist the greater part of whose material received daily from all parts of India for identification consists of larvae); it is necessary however to make colour

notes before preservation. A collection of identified larvae would, at some time, be received with enthusiasm by workers on the subject. I suggest therefore that a second edition might include instructions for preservation of all immature stages in spirit (essential) and also of caterpillars by inflation (useful and easily accessible for reference).

Another point not known to all amateurs is that economic entomologists are crying out for authenticated host-records for parasites. All parasites, together with cocoons, puparia, etc., if kept and labelled are of great value. I do not know what risk there is of some of the 'very rare' species becoming extinct in Ceylon, but certain species of butterflies have been collected to death in the United Kingdom. Perhaps a note on the quality of mercy might be introduced in the next edition.

The words 'fly' for butterfly and 'Nymph' for Nymphalid always make me vaguely irritated, but I understand it is common usage. Also could not the printed pages be numbered continuously to include the appendixes, etc.?

I have no hesitation in recommending this book, which is very good value and I have ordered a copy for my library.

J. C. M. G.

MISCELLANEOUS NOTES

I.—RIVERS AS BARRIERS TO THE DISTRIBUTION OF GIBBONS.

With reference to Mr. R. E. Parson's notes on this subject on pages 434 and 926 of Vol. xlii of the *Journal*: in the course of the Vernay-Hopwood Scientific Expedition in Upper Burma in 1935 we discovered that the Chindwin River served as a barrier between the *Hylobates hoolock* of the areas east of the river, and the same species west of the river.

While the hoolock of the forests west of the Chindwin have only the white band of hair across the forehead, those east of river have, in addition, white hairs across the bridge of the nose; sometimes also in the 'point' of the beard; and always in the preputial region, which in some cases is almost entirely white.

C/O GRINDLAY & CO. LTD.,
BOMBAY,
11th October, 1942.

R. C. MORRIS,
Major.

II.—TIGER CLAW MARKS ON TREES.

With reference to Mr. C. E. Hewetson's note on page 926 of the *Journal*, Vol. xlii, No. 4: in the forest areas of the Kollegal and North Coimbatore Divisions of the Coimbatore District, S. India, it is by no means uncommon to find trees bearing the claw marks of tiger, and occasionally of panther. In 90% of the cases the trees are *Terminalia Arjuna*. In one instance the marks extended to a height of 18 ft. A pair of mating tigers climbed to a height of 16 ft. on one *Arjuna*, and were seen lying on a single large branch.

C/O MESSRS. GRINDLAY & CO. LTD.,
BOMBAY,
11th October, 1942.

R. C. MORRIS,
Major.

III.—SHEEP AT A SALT LICK.

A correspondent writes as follows:—

'I noticed in several issues of *Bomb. Nat. Hist. Society Journal* your articles on the analysis of salt licks and hence this letter.

In the village of Kothamangalam which is about 10 miles due west of Satyamangalam which town is 42 miles N.W. of Coimbatore City, I noticed that sheep after grazing come to a spot just at the edge of the village to eat earth. This place, the villagers told me, had always been thus used by the sheep. A circular basin about

10 ft. in diameter and 1 ft. deep had been scooped out, presumably by the sheep. The soil here is pale pink in colour, extremely dry and mixed with "fine sand". The village is located on the Northern bank of River Bhayani. The analysis of the earth had the following:—

Total solids	...	...	0.260%
<i>Calculated Salts:</i>			
Sodium carbonate Na_2CO_3	...	...	0.021%
Sodium bi-carbonate NaHCO_3	...	...	0.050%
Sodium sulphate Na_2SO_4	...	...	0.010%
Sodium chloride NaCl}	...	...	0.176%

It will be seen that about 68% of the soluble salts is in the form of sodium chloride. This may be the reason why the sheep eat this earth. I noticed that only sheep and a few little calves eat this earth. There were goats and grown up cattle grazing around this spot; but they paid no attention to this spot. There are also pigs in the village. I did not see them eat the earth, though they may do so. Two villagers said that they do eat the earth while many said that they do not eat it. But all agreed that full-grown cattle do not eat it.

The sheep along with very small calves, not much bigger than the sheep, are taken out for grazing early in the morning to the scrub jungle near by. I was told that they never eat the earth in the morning on their way out but only on their return after the feed. I was also told that after a heavy rainfall they do not eat it at all.

The flock returns to the village about an hour before dusk. I was present at the lick before they came near. I could see them racing for the lick in a general melee and when they arrived they attended strictly to business unmindful of any interference. I walked and stroked a few of them without any notice being taken. I caught hold of a ram and pulled it away and I had to use quite a bit of force to do this. The moment I let it go, it made a bound for the lick.

They scraped the earth from the rim of the basin, with their front teeth but never inside the pit. Probably they get a bigger mouthful in this way than in the level portion at the bottom of the pit. They were at the lick for about an hour.

I do not think any wild animals come to this place. It is too near the village and the real jungle is beyond the scrub about five miles away.

Only recently I became aware of your articles: else I would have sent the soil sample on to you. Unfortunately I threw it away after the analysis.

Why do the animals eat the earth? What are the salts they require? Sodium chloride or magnesium and sodium sulphates? Many of your samples contain very little of these salts. Hence, what percentage of these salts should be present in the soil to make them a lick? Kindly enlighten me on these points.'

If you wish to use the information given herewith please do so without hesitation.

EDITORS.

IV.—MIGRATION OF PIED CRESTED CUCKOO
[*CLAMATOR JACOBINUS* (BODDAERT)].

Apropos of Mr. H. Whistler's interesting article on the Migration of the Pied Crested Cuckoo, *Clamator jacobinus* (Boddaert) on p. 136, Vol. xxxiii of this *Journal*, I wish to report that I observed a solitary example of this bird on a pink cassia tree in bloom, by the side of the lane adjoining the Public Gardens, Trivandrum, on 27th and 28th February 1942. After these dates, the bird has not been met with anywhere in this neighbourhood.

The previous records of this bird for Travancore are one female, collected at Cape Comorin on 7-4-'33 by Mr. Salim A. Ali, during the ornithological survey of Travancore and two specimens from Kutyani, about 7 miles north of Trivandrum, dated 21st and 22nd September 1898, sex unknown, in the Trivandrum Museum. Mr. Salim A. Ali describes the pied crested cuckoo as fairly common in the low country about Cape Comorin and Aramboli, inhabiting lightly wooded and Babul scrub terrain and groves of trees in the neighbourhood of cultivation. I visited Kutyani several times in July and August 1933 while engaged in supplementary work connected with the ornithological survey of Travancore, but the bird was noted as absent.

GOVERNMENT MUSEUM,
TRIVANDRUM,
22nd September, 1942.

N. G. PILLAI.

V.—ON THE OCCURRENCE OF THE GREEN-BREASTED
PITTA (*PITTA CUCULLATA* HARTL.), AT SIMLA.

It is worth recording that a specimen of the above was picked up dead in the 'Glen', Simla, at an elevation of 6,000 ft. on the 23rd June 1942 by Master Dick Nunn who had gone to this spot with his father (Col. Nunn), mother and his brother for a picnic. He tells me that it was lying dead on the ground and some ants were crawling over it at the time. It showed no trace of having been in captivity. On skinning it I found that the femur was, high up, badly fractured.

One can only conjecture what brought it so far from its normal habitat which is given in the '*Fauna, Birds*', as the '*Himalayas and Assam*', etc., etc.

SIMLA,
16th December, 1942.

A. E. JONES.

VI.—LOCAL MOVEMENTS OF THE PAINTED PARTRIDGE
(*FRANCOLINUS PICTUS* JARD. & SELBY) ROUND BOMBAY.

In a letter dated the 9th October, 1941, Mr. E. Sheehy of the Bombay Police writes:—

'From the remarks in your book one is led to believe that the painted partridge is scarce owing to constant destruction by

sportsmen. I admit that within Salsette they are fast disappearing but I do not put this down to the sportsmen. The advance of fast and heavy traffic together with the easy access to places by motor car, would tend to drive the game.

'Where these civilised conditions do not exist, i.e. off the beaten tract, I still find this game in plenty. Not far beyond Salsette, say within 15 miles I have had some of the finest shooting available.

'In 1939 with 4 guns we bagged 30 brace.

'In 1938 with 2 guns the days' bag, shooting from 8 a.m. to noon was:—

18 brace partridge (painted)
3 hares
6 couple snipe
15 brace quail (grey)
1 florican

'On the other occasions in the same seasons, a morning's shoot produced 12 brace, 9 brace, 8 brace with 2 guns.

'A few years previous to 1938 thinking that the birds on this ground would be depleted by shooting yearly (I have shot over this country since 1934) I released 48 bought birds in the same country. It is an ideal spot, small scrub jungle and lark country and watered by a stream throughout the year. All these birds were ringed with a white bone ring. I did not shoot this particular ground for 3 years but in 1937 on return from Home leave, realising from the reports of my Shikari that birds were numerous I visited the place with the result that two guns bagged 31 brace shooting from 7 a.m. to noon. The strange thing was that not a single bird was ringed. Shooting the following week at a place some 8 miles further than the spot referred to above we bagged 7 birds with the rings in addition to many without. So I can presume that the parent birds wander away after bringing up the young. Later I shot ringed birds 15 and 20 miles away from the place of their release.

'Another interesting feature; I released 24 ringed birds on the Thana-Belapur Road. Shooting here 2 years after, I found them scarce and did not get a single ringed bird. They were crowing all over the place in the monsoon and I could not understand where they had got to. Shooting some 10 miles on the Bombay side of Panvel, I bagged 6 of these ringed birds amongst others and thus solved the mystery of their migration from the monsoon to the cold weather months which indicated they breed in fairly heavy scrub and then wander off to the grasslands. I estimate the distance from Belapur Road to the Panvel place is some 24 miles and this over the Mumbra Hills'.

I mentioned these records to Mr. H. B. Hayes of the American Express, who knows a lot of the shooting country round Bombay, but his experience with partridge was no better than mine, amounting to two or four birds in a morning.

Mr. Hayes, however, was shooting round Khardi (on the Nasik Road) in May 1941, and bumped into a temporary camp of Phansipardas with their paraphernalia of ponies, goats, dogs, children, poultry, etc. His attention was drawn to an incessant twittering

under a few large nets pegged down to the ground and further investigation proved that there were dozens of partridges under them and two or three peafowls. Mr. Hayes estimated their number at anything between 200 to 500 birds, and it appears that they had recently been caught in the adjoining area.

Most of Bombay's shikaris have pottered round the same country for pig and other game, but I doubt if anybody would estimate the number of partridges in the area at anything near these figures. During the monsoon one hears them calling all round, and one would venture a statement that there were a couple dozen birds in the neighbourhood. After the crops have been harvested and the grass cut down, they disappear and possibly collect in favourable places. Notes from other shikaris would be of interest.

I might mention that several birds shot in early October were in breeding condition and the season which opens officially on the 15th September should be delayed for at least a month, i.e. 15th October.

BOMBAY,

HUMAYUN ABDULALI.

14th December, 1942.

VII.—THE GREAT INDIAN BUSTARD [*CHORIOTIS NIGRICEPS* (VIGORS)] BREEDING IN KUTCH.

I shot a Great Indian Bustard on the 11th October, and found a small chick afterwards—which unfortunately died. However this is the first evidence to *prove* that these bustards breed in Kutch. No local shikari has up to now picked up an egg or seen a chick—although I must say Sir Geoffrey Archer said that bustards must be laying in Kutch.

BHUJ, KUTCH,

MAHARAO VIJAYARAJJI.

20th November, 1942.

[The Great Indian Bustard is known to breed in Gujerat and the Deccan: evidence of its breeding in Kutch was limited to a single egg taken in Kutch in the month of January (Stuart Baker, *Game Birds*, Vol. ii, p. 172). The breeding season varies in almost contiguous areas. Eggs have been taken in the Deccan in April and May and from Gujerat in June and November.—Eds.]

VIII.—EARLY ARRIVAL OF THE SPOTTED SANDGROUSE [*PTEROCLES SENEGALLUS* (LINN.)] IN KUTCH.

I shot over 50 *Waku-Waku* or Spotted Sandgrouse—on the Banni—on the 11th October. This place Neri is not very far from the island of Pachham. The local shikaris told me that these birds had arrived this year a month back, which means early in September. The normal time for their arrival is about the middle of November and even then you don't see them in thousands. On that day, I saw them literally in thousands. I wonder what drove them out from their home—the floods; or the Russians in the Caucasus?

BHUJ, KUTCH,

MAHARAO VIJAYARAJJI.

20th November, 1942.

IX.—ON THE OCCURRENCE OF WOODCOCK
(*SCOLOPAX RUSTICOLA* LINN.) IN KUTCH.

Yuvraj M. K. S. Madansinhji shot the first woodcock in Kutch yesterday, in Bhuj Taluka, near a village called Chakar. In my whole experience, I have *never* seen a woodcock in Kutch, nor *heard* of one. I shall be glad to know about the advent of woodcock in these parts of India.

BHUJ, KUTCH,

20th November, 1942.

MAHARAO VIJAYARAJJI.

[Within Indian limits the woodcock is resident throughout the Himalayas, breeding freely above 10,000 ft. During the cold weather it migrates to every portion of the Indian Empire where there are suitable hills and mountains. In the plains, at any distance from the hills, the bird appears as a rare straggler *en passage* from one range of hills to another. In this way woodcock have been shot in various localities in the plains of India—the record from Kutch is probably an instance in point.—Eds.]

X.—OCCURRENCE OF THE CRAB PLOVER (*DROMAS*
ARDEOLA PAYK.) IN SIND.

I saw a single crab plover on the rocky coast a few miles out of Karachi on 31st May 1942. It was with a party of Saunder's terns. The bird was not wild, and even though twice disturbed by passing fishermen, circled and realighted within a hundred feet of me.

Apparently the crab plover was common in the Karachi harbour in the days of Colonel Le Mesurier (1872, 1874). Now-a-days it is rare and Ticehurst, though constantly on the look out, says he never came across it.

KARACHI (Sadar),
2nd November, 1942.

N. H. MENESSE, I.S.E.,
Executive Engineer,
Karachi Buildings Division.

XI.—UNUSUAL OCCURRENCE OF THE DABCHICK
[*PODICEPS RUFICOLLIS* (VROEG)] AT SIMLA.

This dabchick was picked up by a friend of mine from a roadside drain near 'Rothney Castle' (Hume's old home) on 'Jakko' hill on 17-9-42 and brought to me alive. My friend kept it alive in a bath-tub for a week feeding it on earthworms and insects but it was found dead one morning and handed over to me to preserve.

The skin is now in my collection. Adult ♀. Here we have a clue, I think, to this bird's migratory movements. Was it going North or South? That we don't know.

SIMLA,
16th December, 1942.

A. E. JONES.

XII.—ON THE NUMBER OF YOUNG PRODUCED BY THE
RUSSELL'S VIPER (*VIPERA RUSSELLII*).

Mr. K. R. N. Pillai, Divisional Forest Officer, Akola, Berar reports 'the destruction of 96 baby Russell's Vipers (probably of one brood) in a hole in a mud wall of the forest guard's *naka* in Jubbulpore.' The Russell's Viper is a prolific snake. A specimen in the Society's rooms produced 62 young at a single effort. Some are content with a family of less than 20. Wall believed from his observations on other snakes that 'the oldest mothers are the most fecund'.

B.N.H.S.,

EDITORS.

5th January, 1943.

XIII.—RECORD MAHSEER.

(With two plates).

Many anglers for mahseer have heard of the Record Fish—119 lbs., but no particulars concerning it have hitherto appeared in the *Journal* of our Society.

I am now able to contribute two very interesting photographs: one of the 119 lb. fish, and one of the next largest on record, 110 lbs.

119 lbs.—This fish was caught in the Cauvery river, Mysore State, on the 28th December 1919, by Lieut-Col. J. S. Rivett-Carnac, 14th Lancers, about 44 miles from Mysore at a place called Muduktore. The bait was 'ragi' paste, the time 9 a.m., and the time taken to land the fish 30 minutes. It was gaffed by Mr. P. F. Bowring, Deputy Commissioner of Mysore, and the photograph was taken by the late Mr. Eugene M. Van Ingen. An enlarged copy of the accompanying photograph is framed and hung in the United Service Club, Bangalore.

The measurements of the fish, and the weight, were certified by Mr. Bowring and were: length 64 inches, girth 42 inches, weight 119 lbs. It is not known whether the length was taken to end of tail or fork of tail, and the usual formula $L + \frac{L}{4} \times G^2$ divided by 1,000 makes the weight 141 lbs. The appearance of the fish in the photograph, and the very short time taken to kill it indicate that it was a female spent by spawning and much out of condition. Otherwise it might well have weighed another 15 lbs.; and as it was cut in two for weighment loss on that account may have been some pounds more. I have no doubt it would have weighed as much as 135 lbs. when in good condition.

110 lbs.—This fish, a female also, as are all mahseer much over 50 lbs., was in good condition. It had not spawned, though full of eggs, and showed none of the usual signs of spawning. It was caught in the Cubbany (Kabani) river, Mysore State, on the 22nd October 1938, by Mr. A. E. Lobb, Kartikulam Estate, about 65 miles from Mysore. The bait was 'ragi' paste and the time taken to kill the fish five minutes short of four hours. It was gaffed by



Photo by

E. M. Van Ingen

Mahseer, 119 lbs., caught by the late Lt. Col. J. S. Rivett-Carnac, on the 28th December 1919 in the Cauvery River, Mysore State.



Photo by

A. E. Lobb

Mahseer, 110 lbs., caught by Mr. A. E. Lobb on 22nd October 1938
in the Kabani River, large tributary of the Cauvery, Mysore State.

the late Mr. P. F. Bowring, who was fortunate to have witnessed the taking of these two record mahseer, and gaffed both of them.

Mr. Lobb does not recollect how the length measurement was taken, and gives length as 60 inches and girth 38 inches. This, by the usual formula, makes the fish 108 lbs. as against the 110 it was found to weigh 6½ hours later when cut in two for the purpose. So it was undoubtedly a good 110 lbs. The fish was in good condition as is seen in the photograph, and as indicated by the time taken to kill it.

Mr. Lobb writes:—‘I hooked the fish at 8-45 a.m. and it was gaffed at 12-40 p.m. It was not fighting all the time, but sulked for perhaps two hours out of the four. The fish and I would take a trip round the pool and then have a rest; that is, I had a rest when the fish felt that way. Then a pull or two and we would start off again. Twice I was over the monster when she had her snout in the mud and the great tail waving above the surface. This was towards the last half hour or so. It was a great experience; but exhausting work, as a tight line had to be maintained all the time.’

Mr. J. de Wet Van Ingen of Mysore very kindly sends me a copy of a letter, written by his late father to the *Madras Mail* in 1921, from which I learn that Mr. de Wet Van Ingen caught a mahseer weighing 107 lbs. on the 15th January 1920, in the Cauvery river near Seringapatam. The measurements were 62½ by 38½ girth. Another fish was caught by the late Mr. Bowring near the same place and also weighed 107 lbs. Measurements 61 by 39. And yet another was taken in another part of the same river by the late Mr. Murray Aynsley and weighed 104 lbs.

It is interesting in connexion with these large mahseer to refer to ‘The Rod in India’ where the measurements of a mahseer, believed by Sanderson to have weighed 150 lbs., are the same as those of Mr. Lobb’s 110 lb. fish.

BANGALORE,

Lt.-Col. R. W. BURTON,

1st January, 1943.

Indian Army (retired).

XIV.—ADDITIONS TO THE GAME FISHES OF BOMBAY AND NEIGHBOURING DISTRICTS.

Referring to the Society’s brochure on the game fishes of the Bombay Presidency¹, I think it well worth while to make the following 2 additions:

Silonopangasius childrenii (Sykes). Mahrati name ‘wuluns’.

This fish is in almost every respect a smaller replica of the famous ‘silund’ of the Ganges, but never reaches the size of this well known monster, a 15 pounder being a large one.

I have repeatedly caught this fish, which is fairly numerous in the Indrayani and the Dhima rivers, and found that it takes a leisurely

¹ Game Fishes of Bombay, the Deccan and the neighbouring districts of the Bombay Presidency, Sir Reginald Spence and S. H. Prater, vol. xxxvi, p. 29.

spun 1-172 inch spoon rather well, and gives quite a respectable fight on light tackle. Some of those I hooked jumped clear of the water and ran out a nice length of line.

Some care must be taken in handling this fish as the strong spiny ray in the pectoral fin is extremely sharp and may inflict a deep and painful sting. Native fishermen invariably break it off.

Callichrous bimaculatus.

This is a common fish in many river pools around Poona and will take a fly spoon upto 1 inch with a surprisingly hard pull. Also it may be tempted with a small mahseer fly, and gives very pretty sport on light trout tackle.

I have repeatedly caught upto 2 dozen of these fish in a morning visit to a good haunt of theirs.

They do not often exceed $\frac{3}{4}$ lbs. hereabouts and are rich and very delicious table fish.

Perhaps the above will interest readers of the *Journal*.

116, KOREGAON PARK,

M. SUTER, D.SC.

POONA,

28th October, 1942.

XV.—ON THE WEED-DESTROYING HABIT OF *ETROPLUS SURATENSIS* (BLOCH).

Thomas (1887) and Sundar Raj (1916) have stated that *Etroplus suratensis* (Bloch) is essentially a herbivore. Panikkar (1920) while agreeing with this view, refers to its occasional cannibalistic tendency especially during the breeding season. In consideration of its herbivorous habit, this fish has been recommended as a suitable agent for keeping down excessive vegetation in tanks and ponds. But no attempt seems to have been made to discriminate between those species of aquatic plants it prefers and those it avoids. A number of these fish in one of our aquaria afforded me ample opportunity for observing their feeding habits and studying their preference to certain species of aquatic plants.

Blyxia roxburghi Rich., *Utricularia flexuosa*, *Otella alismoides* Pers. and *Hydrilla verticillata* Casp. are commonly introduced into fresh water aquaria as ornamental plants, but most of these plants serve only as food for *Etroplus*. The fish shows a strong predilection for the first two species and within a few minutes of their introduction into the tanks they are 'picked' clean leaving only the stumps. In the case of *Otella alismoides* Pers., the fish snaps off the broad leaves and then nibbles away the juicy stalks, preferably the tender portions. It does not feed on *Hydrilla verticillata* Casp. When all the above species of plants are introduced together the fish first goes in for *Blyxia roxburghi* Rich. and *Utricularia flexuosa* and only after finishing these does it turn to *Otella alismoides* Pers. The fish often snaps at the floating remnants of its meals, a habit observed and described by Sebastian (1942) in a recent number of this *Journal*.

Other aquatic plants, such as *Elaeocharis* spp., *Chara* spp., and *Nitella* spp., were subsequently introduced into the tank. *Eetroplus* was found to feed on none of them although the fry were observed to peck and nibble at the tender shoots of *Chara*. Even in the absence of other food the fish was found to avoid these plants.

Control of *Pistia* growth in tanks and ponds is a serious problem in this country. Larvae of at least three species of mansonoid mosquito, viz., *Mansonia* (*Mansonioides*) *annulifera* (Theob.), *M.* (*Mansonioides*) *uniformis* (Theob.) and *M.* (*Mansonioides*) *indiana* (Theob.), the carriers of the dreaded filariasis, are known to live attached to the roots of *Pistia stratiota* Linn. The Health Authorities are at present faced with the grave problem of removing *Pistia* from all the tanks and ponds in certain coastal districts in Central Travancore, where the percentage frequency of filariasis is rather high. To discover whether *Eetroplus suratensis* (Bloch) could be of use in checking the growth of *Pistia*, a quantity of these plants were introduced into the *Eetroplus* tank in the Aquarium. The fish appeared to be disturbed by the unusual appearance of the hairy roots, even when accustomed to it, avoided the plant as far as possible. Later it was ascertained that in Central Travancore *Eetroplus* was common in ponds containing an abundant growth of *Pistia*. It seems that the species shows a marked aversion to some floating vegetation such as *Pistia*, *Lemna* and *Eichhornia*.

Incidentally it may be stated that *Eetroplus* is known to take worms and insects and at times it shows a definite predatory tendency. Specimens of *Gambusia affinis* (Baird & Girard) introduced into the aquarium were chased and devoured by them. Whether this was due to carnivorous instincts or to the artificial conditions of life in an aquarium I am not certain. The fact remains that all the *Gambusia* were readily eaten.

MARINE BIOLOGICAL LABORATORY,
UNIVERSITY OF TRAVANCORE,
TRIVANDRUM,
3rd November, 1942.

K. GOPINATH.

XVI.—SOURCES OF FISH SUPPLY TO CALCUTTA MARKETS.

The last year for which statistics of fish imported into Calcutta are available is the year which ended on the 31st March, 1923. In that year approximately 435,194.5 maunds of fish were imported into Calcutta by railways, steamers, country boats and road. It was then stated that 'the most important sources of fish to Calcutta markets are the Padma, the Sundarbans estuaries and the Chilka in Orissa. Very large quantities of *hilsa*, carp and several other species of freshwater fishes come mostly by rail but partly by steamers from the East Bengal'. From Bulletin No. 20 of the late Department of Fisheries, Bengal (Calcutta: 1924), it is clear that the quantity of fish imported into Calcutta was showing a gradual increase for it rose from 308,037.5 maunds in 1918-19 to the figure

for 1922-23 given above, thus registering a net increase in the fish supply of Calcutta by 127,157 maunds in a period of five years. If it be supposed that this rate of increase was maintained then before the advent of the existing abnormal and unsettled conditions, the total supply must have reached one million maunds (1,000,000 mds.). Unfortunately no statistics are available in support of this assumption, but enquiries made in the various Calcutta markets indicate that the fish supply did increase within the last 20 years by about 200 to 300%. Though the methods of capture of fish are still the same, improved methods of preservation and transport made it possible to bring into Calcutta very large quantities of excellent sea fish from the far off deltas at the head of the Bay and the remunerative prices offered in Calcutta attracted fish preserved in ice from several fishing centres as far afield as Assam, Bihar and the U. P.

That the fish supply of Calcutta has increased considerably during the last twenty years is also evident from the fact that whereas in 1923 there was only one wholesale market at Sealdah, there are now several principal fish markets in Calcutta, *viz.*, three markets at Sealdah and one each at Howrah, Ballygunge, Patipukur, Kidderpore, Sir Stuart Hogg's Market, Hathibagan, etc. In order to find out the relative value of the sources of fish supply to Calcutta, one must analyse the statistics available for 1922-23 and compare the data thus collected with the information obtained for 1941-42 through local enquiries.

Comparative statement of fresh fish (in % of total fish supply) imported into Calcutta from different sources:

Year	Salt-water Fish		Fresh-water Fish		
	Sundarban Estuaries	Orissa and Madras coasts, including Chilka Lake	Local, within a radius of 15 to 20 miles	Bengal Districts mostly from the Padma river	Assam, Bihar and U.P.
1922-23	21.80%	7.95%	13.01%	55.52%	1.72%
1941-42	38.00%	3.50%	9.66%	34.34%	14.50%

We may now consider the various sources of supply one by one and see how the Calcutta markets, under the existing emergency condition, have been influenced by them. We may also consider how the supply can be improved from each source so as to relieve the present scarcity of fish.

Sundarban Estuaries:—The Sundarban estuaries have long been recognised to be an inexhaustible store of fish supply for Calcutta, but the main difficulties that stood in the way of increasing the yield from this source were the primitive methods of transport by country boats and absence of any means of preserving fish soon after capture. However, with the advent of motor launches,

especially from 1929 onwards, the estuarine fishery was revolutionised and vast quantities of excellent sea fish, such as Bhekti (*Lates* & *Serranus* spp.), Indian Salmon (*Polynemus* spp.), Rock Salmon (*Otolithus* & allied form), Indian Haddock (*Serranus*), Pomfrets (*Stromateus* spp.), Mulletts (*Mugil* spp.), Hilsa, Bagda, Golda, Chapda and Ghoosa chingris (Prawns and Lobsters), Crabs, (*Scylla serrata*), etc., became available in Calcutta at competitive rates in excellent condition of preservation, for these launches during their outward trip carried ice with them for the preservation of fish. Though in 1940-41, fish from this source formed only 38% of the total supply of Calcutta, in actual maundage, i.e., about 380,000 maunds, this quantity exceeded the total supply of Calcutta during 1918-1919. Though there is always plenty of fish in the Sundarbans, the primitive methods of fishing and frail fishing boats make it more or less a seasonal fishery. The main fishing season starts from October and lasts till February, but from the enclosed salt-water fisheries, known as 'Bhasa Badha', large quantities are exported during the off season also when the fish fetch better prices. The following table shows the variation in the proportion of fish imported into Calcutta from the estuaries month by month.

*Statement showing quantities of fish (in % of total fish supply)
imported into Calcutta from the estuaries month by month.*

Jan.	Feb.	Mar.	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
50	40	37	25	15	20	30	35	45	50	55	55

It will be seen from the above statement that starting from the middle of September and lasting up to the middle of February the fishing season is very brisk in the Sundarbans and imports from this source form more than half of the total supplies imported into Calcutta. During January, February and March, young of Hilsa, under a foot in length, form $\frac{1}{3}$, Bagda chingri $\frac{1}{3}$, Bhekti $\frac{1}{6}$ and the other fishes, such as Rock Salmon, Mulletts, Pomfrets, Haddocks, etc. the remaining $\frac{1}{6}$ of the total supplies imported into Calcutta markets from this source. In April, the composition of the catches undergoes a considerable change for Hilsa is not available in the estuaries at this season. During April, May and June, the supply comprises $\frac{1}{3}$ Bhekti, $\frac{1}{3}$ small prawns and $\frac{1}{3}$ Rock Salmon, Mulletts, Pomfrets, Haddock, etc. all combined. With the establishment of the monsoons, the Hilsa shoals begin to ascend the estuaries and though this migration stops in the middle reaches of the rivers about October, in the Sundarbans adult Hilsa is caught in large quantities from July to September and young Hilsa from October to March. Thus during July to December the fish supply from this source comprises $\frac{1}{3}$ Hilsa, $\frac{1}{3}$ Bagda chingri, $\frac{1}{6}$ Bhekti and $\frac{1}{6}$ the remaining varieties of fishes enumerated above.

Mention must also be made of two other important seasonal fisheries in the Sundarbans, i.e., Tengra (*Mystus gulio*) and Sea-Pangas (Ariidae). Shoals of Tengra appear in April-May and their fishery lasts for about three months while the shoals of Sea-Pangas enter the estuaries during August, September and October.

Chilka Lake, Orissa and Madras Coasts:—Though the percentage of salt water fish imported from Orissa and Madras shows a decrease, the actual maundage has increased slightly. In November, December and January somewhat larger supply is received from these areas, otherwise the supply remains constant throughout the year. The chief varieties of fish imported are Hilsa, Bhekti, Rock Salmon, Mulletts, Haddocks and Prawns, while at certain seasons freshwater fish, such as Carps, are also imported from Orissa. It was in the second decade of the present century that a market in Calcutta for fish from the Chilka Lake began to grow. In 1924, the export of fish, fresh and cured, by rail from this source amounted to 45,000 maunds and by 1937 it had arisen to 71,366 maunds, of which the fresh fish amounted to 60,000 maunds. Though a considerable amount of this supply came to Calcutta, some was distributed to other towns as well.

Statement showing quantities of fish (in % of total fish supply) imported into Calcutta from the Orissa and Madras Coasts (including the Chilka Lake) month by month.

Jan.	Feb.	Mar.	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
5	3	3	3	3	3	3	3	3	3	4	5

This source of supply can be effective only when fast trains are running at times suitable for the fish trade, but at present the timing of the Madras Mail and the slow running of trains are greatly hampering the fish trade between these areas and Calcutta.

Local Supply:—Though the salt-water varieties of fishes that used to be available from local sources during 1922-23 are not now found in the neighbourhood of Calcutta on account of the silting up of the Bidyadhari river and, in consequence, of the absence of salt-water fisheries in the Salt Lakes, Calcutta, the supply of Carp and other varieties of fresh-water fishes has increased considerably. The greater part of the Bidyadhari Spill Area, partly assisted by the Calcutta sewage, is now being used for the cultivation of Carp and considerable quantities of Pona fish are thus available from this source. It will also be noticed that though the percentage of the total fish supply from local sources is now less, the actual maundage is almost double of what it used to be in 1922-23. As is shown in the statement given below, the main supply from the local fisheries is during the dry months of February, March and April and to a certain extent in May, when the shallow fisheries are dewatered and most of the fish, that had been stocked during the rainy season, are removed for sale. However, a certain amount of fish from the areas within a radius of 20 miles of Calcutta is always available in the markets of the town. The great possibilities of meeting the present situation are by developing this source of supply, because it is not effected by any kind of restrictions either on fishing or on transport. With the death of the Bidyadhari and deterioration of the Piali rivers, there are vast sheets of water in the neighbourhood of Calcutta which cannot be drained and are at present unproductive and a regular source of nuisance to public health. These should be stocked for increasing the local supply.

Statement showing quantities of fish (in % of total fish supply) imported into Calcutta from within a radius of 20 miles month by month.

Jan.	Feb.	Mar.	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
5	15	25	32	10	5	4	4	4	4	4	4

Bengal Districts :—The supply of fish to the Calcutta markets from the Bengal districts is considerable but this, during the rainy season, mainly consists of Hilsa from the Padma river and during the other seasons, of Carp, which is extensively cultivated in Bhils and tanks of every part of Bengal. Attention may, however, be directed to the fact that during May, June, July and August, when the supply from the estuaries becomes greatly reduced, the imports of Hilsa from the Padma makes up the deficiency. During October and November, when the waters begin to dry up and it is possible to catch freshwater fishes in large quantities, it is then that we find that the supplies from the Bengal districts are almost equal to one-third of the total import of fishes into the Calcutta markets.

Owing to restrictions on transport by Railways, the supply has also decreased to a certain extent and for this reason Calcutta felt a great shortage of fish during the early part of summer last year. When the swarms of Hilsa came up the river about the middle of August, then the situation was eased to a considerable extent. Much improvement can be effected in this source of supply by the Railways agreeing to grant adequate facilities for the transport of fish.

Statement showing quantities of fish (in % of total fish supply) imported into Calcutta from the Bengal Districts month by month.

Jan.	Feb.	Mar.	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
30	30	20	22	50	50	40	45	35	30	30	30

Assam, Bihar & U.P. :—In the dry months when the waters dry up considerably, large quantities of freshwater fish in inland fishing centres are caught and as better prices always prevail in the Calcutta markets, considerable supplies of fresh fishes, packed in ice, are imported from Assam, Bihar and the U.P. The transport difficulties by Railways, referred to above, had an adverse effect on this source of supply. It is difficult to judge how far this supply can be revived under the existing emergency conditions, but I think the co-operation of the Railway authorities can be very helpful in this connection.

Statement showing quantities of fish (in % of total fish supply) imported into Calcutta from Assam, Bihar and U.P., month by month.

Jan.	Feb.	Mar.	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
10	12	15	18	22	22	23	13	13	13	7	6

The following table shows at a glance the relative value of the various sources of fish supply to the Calcutta Markets and the varieties of fish that are imported from each source:—

Month	Salt-water Fish		Fresh-water Fish		
	Estuaries	Orissa and Madras coast including Chilka Lake	Local supply within a radius of 20 miles	Bengal Districts	Assam, Bihar and U.P.
Jan. ...	50%	5%	5%	30%	10%
Feb. ...	40%	3%	15%	39%	12%
Mar. ...	37%	3%	25%	20%	15%
April ...	25%	3%	32%	22%	18%
May ...	15%	3%	10%	50%	22%
June ...	20%	3%	5%	50%	22%
July ...	30%	3%	4%	40%	23%
Aug. ...	35%	3%	4%	45%	13%
Sept. ...	45%	3%	4%	35%	13%
Oct. ...	50%	3%	4%	30%	13%
Nov. ...	55%	4%	4%	30%	7%
Dec. ...	55%	5%	4%	30%	6%
For the whole year	38.00%	3.50%	9.66%	34.34%	14.5%
Varities of fish available from different sources.	From July to March $\frac{1}{3}$ of the catch is Hilsa, $\frac{1}{3}$ Bagda chingri, $\frac{1}{6}$ Bhekti, and $\frac{1}{6}$ Rock Salmon, Mulletts, Pomfrets, Haddock, etc. From April to June $\frac{1}{3}$ of the catch is Bhekti, $\frac{1}{3}$ small prawns, $\frac{1}{3}$ Rock Salmon, Mulletts, Pomfrets, Haddock, etc.		Mostly Hilsa, Bhekti, Rock Salmon, Indian Salmon, Mulletts, Haddocks and Prawns. Carps in small quantities at certain seasons.	Carps, Jiol fish and Prawns.	From June to October, $\frac{3}{4}$ of the catch is Hilsa and the rest Carps, Jiol fish, etc. November to February $\frac{2}{3}$ of the catch is Carps, $\frac{2}{3}$ Cat fishes and the rest Jiol fish, Prawns, etc. From March to May, $\frac{1}{10}$ of the catch is small Hilsa and the rest Carps, Jiol fish, Prawns, etc.
					Mostly Carps; also a very small quantity of Hilsa and Catfishes.

Besides transport difficulties and the unavoidable restrictions on fishing in the Denial Area, attention must also be directed to the fact that due to oil shortage a number of ice factories have not been able to work full time and thus sufficient ice is not available in these days for the proper preservation of fishes. For this reason also the supply imported into Calcutta has sometimes to be curtailed. The number of factors that have brought about the high prices of other, even non-perishable, commodities due to the present emergency conditions have also operated in the case of the fish trade and there are reasons to believe that the fish merchants may have artificially raised the prices to some extent, but there can

hardly be any doubt that the supplies, due to the various reasons cited above, have decreased very materially and result has been the increase in the price of fish in the Calcutta markets and perhaps in other larger mofussil towns also.

Whatever steps it may be possible for the Government to take to increase the fish supply to the Calcutta markets, the fact will remain that the supply, which has never been adequate even in the past, will remain insufficient so long as the present emergency conditions last. The need of the moment is, therefore, that we must definitely concentrate on increasing the local production of fish by stocking all pieces of water and of conserving our existing supplies in such a way as to get the maximum benefit out of them.

I, DEODAR STREET, BALLYGUNGE.

CALCUTTA,

16th December, 1942.

S. L. HORA,

Director of Fisheries,

Bengal.

XVII.—NOTE ON *CURETIS* SPECIES AT KALLAR.

Kallar is at the foot of the Mettupalaiyam Ghat below Coonoor. Its altitude is 1,250 ft. and it is locally abounding in butterflies.

1. *Curetis thetis*, Drury.

This was the only species observed by Hampson in the Nilgiris. He notes, '1,000 ft. to 3,000 ft. S. and W. slopes of the Nilgiris. Very rare. Outer margin of the H. W. much rounded. Both orange and white females are found (?) 'The question mark is mine.

C. thetis is rare at Kallar but I have seen or caught it on the following dates:—♂ 28/3, ♀ 31/7, ♀ 14/8, ♀ ♀ 22/9. The female is a jungle insect, a characteristic shared to some extent by the females of the other two species. The male does not seem to be attracted much by moisture, and the female will usually be caught settling on the underside of leaves.

2. *Curetis bulis*, Db. and Hew.

3. *Curetis acuta dentata*, Moore.

C. acuta is rare but I have records of it on the following dates:—♂ 31/1, ♂ 28/3, ♂ 16/7, ♀ 7/12, ♂ May, ♀ 20/9 (Ootacamund). All the males were caught settling on damp sand, but the females do not seem to be attracted by moisture.

I also have one definite specimen of *bulis* ♂ taken on 6/12, and another doubtful specimen ♂ caught on 10/5. These also were taken on damp sand. I have no information that *bulis* has been recorded as a South Indian species before, and Evans gives its range as Mussootie—S. Burma. I have come across no females, but the females of both these species seem to be very scarce.

The following are comparative measurements :—

KALLAR	Other specimens in my collection. (Burma, Assam, E. & W. Himalayas.)	Evans measurements.
<i>acuta</i> ♂♂ 43–44 mm.	♂♂ 40.6 mm. (average.)	40–50 mm. for both sexes.
<i>bulis</i> ♂♂ 45 and 44 mm.	♂♂ 46 mm. (average.)	¹ 55–45 mm. for both sexes
<i>acuta</i> ♀ 50 mm. (Ootacamund.)	♀♀ 50 mm. (average.)	.....

In *acuta* all the Kallar specimens are small and the HW is much more rounded and the FW less pointed than is the case with other specimens in my collection. They are very constant in shape and size and would seem to warrant subspecific rank. My two (?) specimens of *bulis* exhibit the same characteristics.

Evans states that in *bulis* the upper portion of the discal band in 6 and 7 on the UNH is not in line with the bar at the end of the cell: in *acuta* it is in line. My experience is that this is not strictly the case, as, in the majority of my specimens of *acuta* it is slightly out of alignment with the discal band though occasionally it is in direct alignment. In my first specimen of *bulis* the bar and the band are more out of alignment than is the case in any other of my specimens. In the second specimen it is sufficiently out of line for me to identify it as *bulis*, but the upperside is that of *acuta*, whereas in the first specimen the upperside markings are typical of *bulis*. The second specimen has a great deal of orange on the HW and the tooth on the forewing is definite. This, however, may be due to its being a DS butterfly whereas the other one is a WS specimen.

The only local specimen of ♀ *acuta* in my possession is one from the collection of the late O. C. Ollenbach, Esq., and is rather vaguely marked 'Ootacamund'. As this is large and much more of the shape and size of my northern specimens I suspect that it comes from the drier northern slopes of the Nilgiris. It would surprise me to meet with any *Curetis* at the altitude of Ootacamund town.

To conclude, I have had no experience of *Curetis* from elsewhere in Southern India and the particular characteristics I have mentioned may be peculiar to most specimens from the south. Nevertheless, it seems to me that a subspecies is indicated, whether for this locality or for a larger area.

KETTI, NILGIRIS,
5th Oct. 1942.

M. A. WYNTER-BLYTH.

XVIII. ADDITIONS TO THE LIST OF SIMLA BUTTERFLIES PUBLISHED IN VOL. XLI, NO. 4.

1. *Papilio machaon asiatica*, v. *ladakensis*, Moore. Poo, July, 1941. (Inner hills.)
2. *Ismene aedipodea aegina*, Plotz. Simla, Spring, 1942. Hitherto not recorded west of Mussoorie.

¹ Evans measurements seem to me to be on the small side.

The following rarities have also been recorded:—

Appias lalage lalage, Doubleday. Previously recorded only from Summerhill and the Glen in May, 1938. Fresh record from Sanawar in 1942.

Amblypodia alemon, de Niceville. Simla, 1940. Recorded once before.

Virachola perse perse, Hew. Sanawar, 1941. Recorded once before some years ago in the Kalka neighbourhood.

KETTI, NILGIRIS,

M. A. WYNTER-BLYTH.

5th October, 1942.

XIX.—NOTES ON TWO MAJOR CATERPILLAR PESTS OF *EUGENIA JAMBOS* (ROSE APPLE).

(With a plate).

Eugenia jambos is a favourite plant in most private gardens in Travancore, grown for shade, ornament and for its sweet rose-scented fruit. The tree puts forth fresh shoots twice in the year after the S.W. and the N.E. monsoons. When fresh tender shoots with small copper coloured leaves appear in profusion, they are subject to the attack of a number of insects, chief among which are the two leaf-eating caterpillars described in this paper. Among others are the Lasiocampid caterpillar *Metanistria hyrtaca* Cr., the Geometrid *Thalassodes flavifusata* Wlk, the Tortricid *Homona coffearia* N., a shoot boring caterpillar (unidentified), a leaf miner (unidentified), a species of *Apoderus* twisting up the leaf tips for oviposition, etc.

The two major caterpillar pests are the Noctuid *Bombotelia delatrix* Guen, and the Eucosmid *Argyroplöce mormopa* Meyrick.

1. *Bombotelia* (*Eutelia*) *delatrix* Guen.

Life-history.—Eggs are laid singly (Fig. 1) both on the upper and on the lower surfaces of tender foliage. The egg (Fig. 2) is circular, 1.3 mm. in diameter and plano-convex. Two distinct regions can be made out—a thin ring-like peripheral region, closely adherent to the leaf surface and the central region. The central region is slightly convex and is of a creamy white colour. Fine radial striations start from the centre of the egg and radiate towards the periphery.

The egg hatches in 3-4 days and the larva issues out through a slit at the edge of the central region. The newly-hatched larva is 2 mm. long and is light yellow, with a slight greenish tinge. It starts eating small holes in the tender leaf and, after a day or two, drops to the leaf below by means of a slender thread. After the first moult, the caterpillar begins to feed voraciously. It feeds mostly at night, remaining quiescent on the leaf throughout the day, and gets full-grown in 12-14 days.

The full-fed larva (Fig. 3) is 25 mm. long and about 6 mm. broad. The colour is still yellowish green, the larva not undergoing any change in colouration during its growth. The head is of the same colour as the body and it is only just before pupation that the prothoracic shield becomes at all distinguishable. A narrow whitish longitudinal subdorsal line becomes faintly visible on each side after the second moult. In the full-grown larva these lines are more distinct and are seen to extend from the prothorax to the anal segment. There are five pairs of prolegs and the crochets are uniordinal and arranged in mososeries. (The caterpillar of the present species can be easily distinguished from that of *B. jocosatrix*, a common pest of mango in Travancore, by the absence of the small purple spots on the somites, so characteristic a feature of the latter).

Prior to pupation, the caterpillar turns pinkish and the head plates become slaty grey. The caterpillar constructs a loose cocoon of silk covered over by pellets of excreta. The pupa (Fig. 4) is 13 mm. long, 5 mm. broad, and dark brown in colour. Pupal period about 13 days. (For a description of the moth (Fig. 5) vide Hampson's Moths, Vol. II, p. 391).

Natural enemies.—Though all the larvae collected from the affected trees, and reared in the insectary looked apparently healthy and pupated, moths failed to emerge from 50% of the pupae, in every one of which a large oval pupa of a Tachinid fly was noticed. This was also the case in a number of larvae reared from eggs, even though the greatest care was taken to see that the fly had no access to the caterpillars. It would appear that in the case of this Tachinid (as in certain others) large numbers of very minute eggs are laid on the tender leaves (the food of the host) and that the eggs with the contained fully-formed embryos are swallowed by the caterpillars during the process of feeding, and the embryos get liberated in the alimentary canal. This point, however, requires further investigation.

Economic Status:—The caterpillar is a major pest of *Eugenia jambos* as the damage to tender foliage is often very serious. The pest has also been found to be very destructive to young plants of *Eugenia javanica*.

2. *Argyroplote mormopa* Meyrick (*Eucosmidae*).

Life-history:—Eggs are laid singly on the upper and lower surfaces of tender foliage. The eggs are circular with a diameter of 1.02-1.1 mm. and are divisible into a central slightly convex embryonic part and a narrow very thin marginal part as those of *Bombotelia delatrix* from which, however, they can easily be distinguished by the absence of the radiating lines so characteristic of the latter.

The incubation period of the egg is 4-5 days. The newly-hatched larva is 1.5 mm. long with a brownish green body and a black massive shiny head. On hatching, the larva webs up the very tender leaves at the apex of the young shoot and begins to eat holes through the leafy tissue. After the first moult, the larva turns pale pink, the head becomes dark brown and the prothorax brown. The



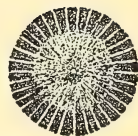
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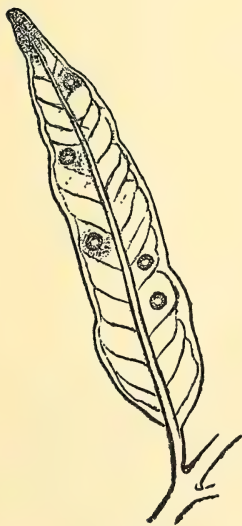
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2



1



6

K. S. Padmanabha Aiyar—Caterpillar Pests of *Eugenia jambos*.

(For explanation see end of Note).

growing caterpillar feeds in concealment, remaining between two webbed up leaves or in a scroll-like leaf-fold, the whorls of the scroll securely fastened together by silk.

The full-fed larva is 15 mm. long and dark pink in colour. The head is brown or brownish yellow. The half moon shaped prothoracic shield is dark brown and covers the whole of the dorsal side of the segment. The anal shield is blackish. The thoracic legs are black. There are five pairs of prolegs the claw like crotchets of which are arranged in a complete circle. Warts are present on the somites from each of which two or three short hairs arise. The larval period is about 18 days.

The full-fed caterpillar pupates inside the webbed up shoot or between a webbed up pair of leaves in a loose cocoon of silk. The pupa is 7.5 mm. long, brownish dorsally, greenish ventrally with the wings brownish green. Pupal period is 7 days.

Moth.—vide description by Meyrick in *J.B.N.H.S.* (1906), p. 136.

Economic Status.—The damage caused to young shoots and tender foliage is sometimes serious and the pest may be classed among the major pests of this fruit tree.

EXPLANATION OF PLATE.

- | | | |
|---------|------------------------------|------------------------------|
| Fig. 1. | <i>Bombotelia delatrix</i> , | eggs on <i>Eugenia</i> leaf. |
| " 2. | Do. | egg (highly magnified). |
| " 3. | Do. | Full grown larva. |
| " 4. | Do. | Pupa. |
| " 5. | Do. | Moth. |
| " 6. | <i>Argyroblote mormopa</i> | Moth. |

TRIVANDRUM,
15th Nov. 1942.

K. S. PADMANABHA AIYAR, D.Sc.,
Central Research Institute,
University of Travancore.

XX.—A NOTE ON THE EGG-LAYING HABITS OF THE INDIAN GLOW-WORM (*LAMPORPHORUS TENEBROSUS* WLK.)

(With one plate)

Paiva in the *Rec. Ind. Mus.* XVI, 1919, records the luminosity of the few eggs laid by a single female glow-worm. Later on Hutson and Austin in the Ceylon Agricultural Bulletin No. 69, 1924, describe briefly the egg-laying habits of *Lamporphorus*. Their observations were made from 1921 to 1923 on material collected at Peradeniya, Ceylon. According to them the 'oviposition period' lasts from 1 to 3 weeks and is followed by a 'post-oviposition period' during which the female incubates. 'Females which have not had a chance of mating will still lay eggs, but none of the eggs will hatch, merely turning black and drying up.'

The following observations of mine were made during the years 1939 to '42 from material collected at Tambaram, Chingleput District.

Although the larvae at various instars are obtainable throughout the year, the females make their appearance only during the rainy months. They were collected from different localities mostly from inside thorny bushes.

The adult female *Lamprophorus* is exactly like a larva except for its creamy white colour and a few other definite anatomical peculiarities, especially those concerning the antennae and the tarsi. The larvae which have just emerged from a moult also resemble the adult female in colour. But their antennae and tarsi differ fundamentally from the adult coleopteran style.

The female which is normally sluggish during daytime is unusually restless during oviposition. The eggs are laid both during day and night. The eggs when laid are very light yellow in colour, but become darker with time. They are spherical and without any sculpture or ornamentation and vary from 3.00 mm. to 3.50 mm. in diameter. The eggs are faintly luminescent. The luminosity of the egg lasts for several days. Their glow is faintly noticeable even from inside spirit for a few hours. Before oviposition, the female makes a shallow open burrow over which she coils herself in a quiet pose for hours together. So far I have not observed any deep or closed burrow constructed for the purpose. When eggs are being laid occasional convulsions are seen towards the posterior portion of the body. The convulsions sometimes occur at definite intervals. The whole *anal brush*¹ is retracted into the last segment and the posterior most segments are pushed in and out and bulge and relax moving from side to side. During oviposition as far as possible, the same place is sought. Almost all the eggs are laid over the same burrow to form a single heap, over which the mother coils round. If the female is disturbed during oviposition she creeps about restlessly for a long time emitting the brightest glow from her photogenic organ. Sometimes she leaves the burrow and cleans her body busily with her anal brush and again creeps back to the burrow. She is also sometimes noticed to lay eggs singly, slightly outside the burrow and then she carries them by the fore-legs and deposits them over the original heap.

A female (Female A) which emerged from her pupal skin on 25th September 1941, was taken to the laboratory and left in a large glass trough over moist earth. The first eggs were laid on 6th October 1941, the 'preoviposition' period lasting for about 10 days. The last egg was laid on 16th October, the 'oviposition period' lasting for about 11 days, during which time she had laid 57 eggs, all singly varying from 2 to 9 per day. Of these about half the number of eggs were laid during daytime and the rest at night. Of the 6 eggs laid on 10th Oct. morning, 2 were laid outside the original heap, and the 2 eggs laid on 8th night were laid in two separate places. All the remaining eggs were laid in the same heap over the same burrow.

¹ Raj, J. S. 'The Giant Glow-Worm of Tambaram', *Madras Christian College Magazine*, Vol. xi, No. 2, December 1941, page 88.

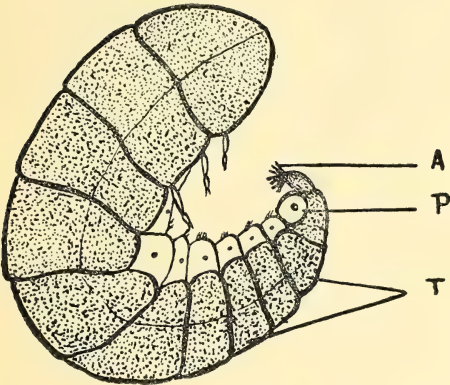


FIG. 1.

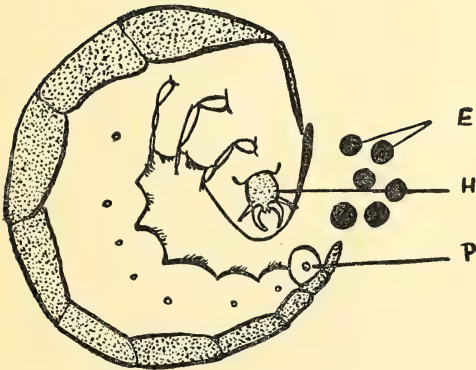


FIG. 2.

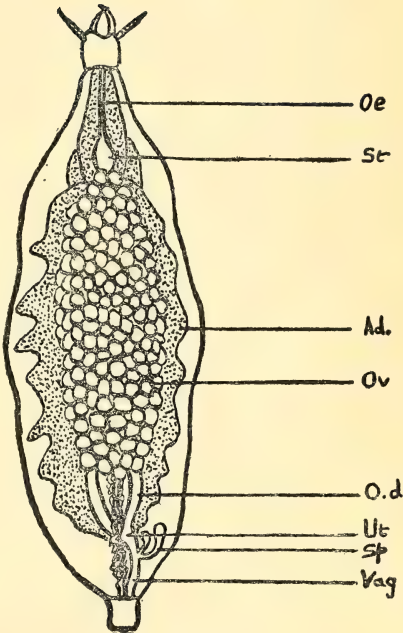


FIG. 3.

J. S. Raj—Indian Glow-Worm (*Lamprophorus tenebrosus* Wlk.)

(For explanation see end of Note).

The following scheme gives the details regarding the number of eggs laid by Female A.

FEMALE A.

Date.	Time.	No. of eggs laid.
6th Oct. 1941	Afternoon ...	3
7th "	About 6 p.m. ...	1
7th "	Late in the night ...	4
8th "	Night ...	2
9th "	Morning ...	2
9th "	About 2 p.m. ...	3
10th "	Morning ...	6
10th "	About 11 a.m. ...	2
11th } "	" "	25
12th }		
13th }		
14th } "	" "	9
15th }		
& 16th }		
Total number of eggs laid ...		57

After 48 eggs were laid a few older ones turned dark and dried up and most of them were attacked by fungi. Later on some of the freshly laid eggs were removed immediately to dry earth, but soon they too turned black and died out. So I could not get them hatched. On 22nd October, the female also died. The female was dissected immediately and found to contain over 100 normal eggs in the ovary. But here and there were noticed a few dark eggs. From the single massive ovary which occupied almost the whole of the interior just beneath the adipose layer and above the alimentary tract, start two short, fairly stout oviducts which meet to form the uterus, which leads on to the vagina. From in between the uterus and vagina were observed two (a small and a large) spermathecae, both loaded with sperms.

The question arises, whether the eggs laid were fertilised or not. Hutson and Austin during their breeding experiments had cases where the eggs laid 'merely turned black and dried up.' These they described as unfertilised eggs, i.e., eggs laid by females which have not had a chance of mating. The Female A, which I have described is interesting. She laid 57 eggs in all and all turned black and dried up and were attacked by fungi. But the presence of sperms in the spermathecae confirms that Female A had definitely mated before oviposition. At present with the little material at hand I can only conclude by saying that even females which have had a chance of mating will lay eggs which are destined to turn black and dry up.

EXPLANATION OF PLATE.

1. Normal resting position of the female (Note the head is with-drawn under the pronotum). A anal brush; P photogenic organ; T tergal plates.

2. Egg-laying position of the female.

3. The Reproductive system of Female A. Ad. Adipose layer; Ov. Ovary; Od. Oviduct; Ut. Uterus; Sp. Spermatheca; Vag. Vagina.

TAMBARAM,

J. SAMUEL RAJ, B.A., B.Sc. (Hons.),

12th Nov. 42.

Demonstrator in Zoology,

Madras Christian College.

XXI.—THE MORPHOLOGY OF THE SPINES OF *HYGROPHILA SPINOSA* T. ANDERS.

(With one plate).

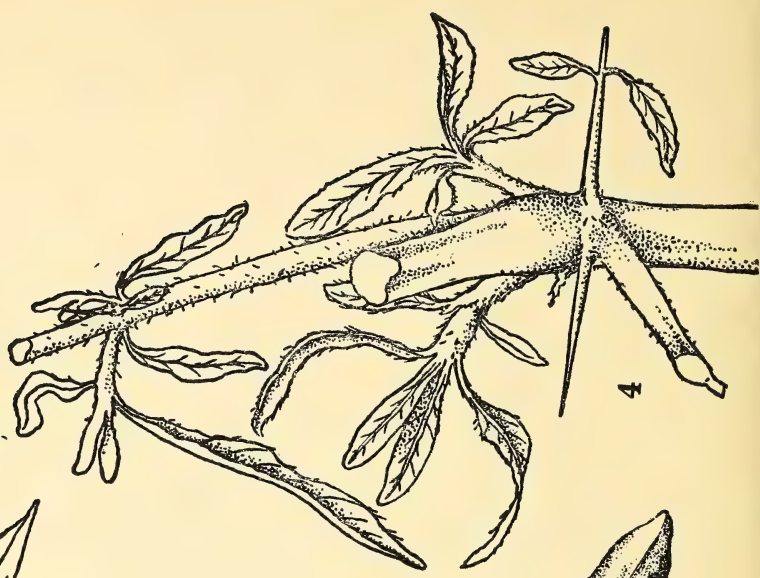
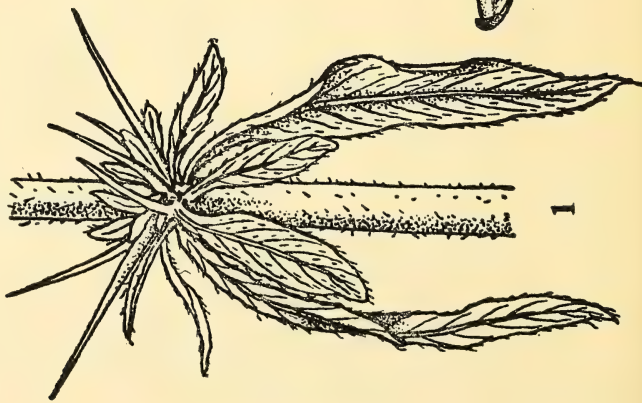
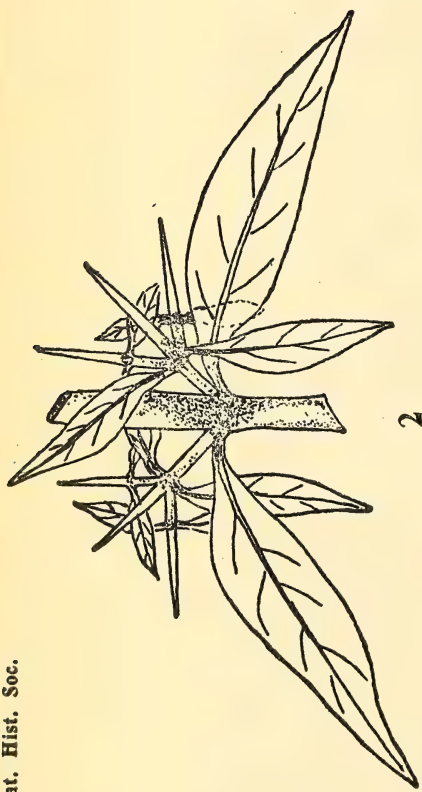
Hygrophila spinosa T. Anders. (= *Asteracantha longifolia* Nees, *Ruellia longifolia* Roxb., Fam. *Acanthaceae*) is a herb growing usually in marshy or aquatic situations and attaining a height of about 70-80 cm. The plant is rather common and is distributed throughout India, Burma and Ceylon.

Position of the spines.

The stem bears at each node two opposite leaves which are linear-lanceolate in shape: the main stem seldom develops normal branches. Instead of elongated leafy branches there are at each node usually 6 stout, straight or slightly incurved 'spines', 3 being on each side (fig. 1). The length of the 'spines' varies from 1 to 4 cm. Besides the spines there are a number of leaves at the node; all of them are so crowded together that their arrangement is not very clear and the morphology of the 'spines' is not easily understood. Occasionally one or more of these 'spines' develop small leaves and thus show their branch nature; but such a phenomenon does not explain the morphology of all the 'spines' and their relation to one another.

Morphology of the spines and their arrangement at the nodes.

The arrangement of these 'spines' at the node has been studied and their morphology has been determined. All the 6 'spines' seem to develop from the node, but in reality only two develop at the node each in the axil of each of the two opposite leaves; the remaining four develop as secondary branches of these two. The method of branching may be explained as follows: in the axil of a leaf a branch develops: the terminal bud of this branch soon ceases to grow and the whole structure becomes hard and woody and is modified into a 'spine'; normally such a short branch does not develop evident nodes and internodes, but develops two opposite leaves at its first node, the internode below this node becoming entirely suppressed; on account of this, these two leaves appear to develop from the node of the main stem on the two sides of the suppressed branch. Each of these leaves bears a branch in its axil which is also modified into a 'spine'; this also develops two opposite



leaves at its first node, the internode below it also becoming suppressed.

Thus at a node there are two main branches, the primary 'spines' (each in the axil of each of the two opposite leaves), each of which also develops two lateral branches, the secondary 'spines', and so altogether we get 6 'spines'; as the first internode of the primary 'spines' remain suppressed, all the 6 spines are crowded at the node with 6 pairs of opposite leaves (minus the two leaves of the main stem). Occasionally the number of spines may be 5 or less in number, on account of one or more of the secondary spines not being developed. The method of branching as described above is shown in a diagram (fig. 2) where the first internodes of the suppressed branches ('spines') are shown elongated. (See also figure 3).

The arrangement of the leaves and 'spines' at the node becomes further complicated by the crowding of the flowers. They are always axillary, developing in the axils of the leaves of the 'spines'.

Roxburgh (1832) describes the arrangement of the leaves and 'spines' in the following way; 'Leaves verticilled; an exterior, opposite sessile pair at each joint, within these, and subalternate with the spines, several small ones in a verticil. Spines 6 in each verticil between the leaves and flowers.' It appears from the present study that the above description given by Roxburgh is not correct.

Transition from spines to normal foliage shoots.

Occasionally, however, the suppressed branches, particularly the primary ones become normal long foliage shoots instead of being transformed into spines. Such a long branch, like the main stem, bears opposite leaves at each node, which usually develop 2 or more 'spines' in their axils. The secondary 'spines' like the primary ones may develop into short branches. Fig. 3 shows a case where all the 'spines' have been transformed into shoots. In certain cases the spines may not grow out into branches, but have been found to develop nodes and short internodes; small leaves develop from such nodes. All stages of transition from 'spines' to elongated foliage shoots can be observed in different specimens. In a particular example, on one side of the node the three spines have all developed into long shoots, but on the other side only the primary spine is so transformed (fig. 4). In another specimen each of the buds in the axil of 2 opposite leaves of the main stem instead of being transformed into a spine develops a leafy branch; the secondary 'spines' in this specimen have not developed.

The transition from 'spines' to normal foliage shoots appear to depend on environmental conditions. In plants of *Hygrophila spinosa* growing in comparatively drier situations, the 'spines' have never been observed to be transformed into foliage shoots. In specimens growing in water, the 'spines' particularly those growing in contact with water always show a tendency of elongating into foliage shoots.

Similar elongation of spinous shoots may be brought about experimentally and has been described in other species by Goebel (1905) and Troll (1937). It has been said that if the terminal shoot

is cut off above the region of the spines, the spines are prolonged out into normal leafy branches with distinct nodes and internodes.

Conclusion.

All the six spines found at a node of the stem of *Hygrophila spinosa* are modified branches. Only two of them really grow from the axil of the two opposite leaves at the node of the main stem and the other four develop as secondary branches of these two.

The term 'spine' and 'thorn' are often regarded as synonymous. They have also been used by some to denote different senses, viz., thorn for a modified shoot and spine for a modified leaf or part of a leaf. Kundu (1942) has reviewed the whole question and supported the latter view. So the 'spines' of *Hygrophila spinosa* should be described as thorns.

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EXPLANATION OF PLATE FIGURES.

Fig. 1.—A portion of the stem of *H. spinosa* T. Anders, showing the leaves and the 6 spines at a node.

Fig. 2.—A diagram of a portion of the stem of *H. spinosa* to explain the method of branching and the relation of the spines to one another. In the diagram the suppressed basal internodes of the 'primary' and 'secondary' spines are shown elongated.

Fig. 3.—A stem-node of *H. spinosa* where all the spines have been transformed into short shoots.

Fig. 4.—A stem-node of *H. spinosa* T. Anders, from which all the leaves have been removed. On one side all the 3 spines have been transformed into branches and on the other side only the primary spine is so transformed.

PRESIDENCY COLLEGE,
CALCUTTA.

B. C. KUNDU.

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